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THE MONTHLY
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EDITED BY
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PROFESSOR OF CHEMISTRY TO THE MUSEUM OF IRISH INDUSTRY, DUBLIN.

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THE

JOURNAL OF INDUSTRIAL PROGRESS.

No. I.—JANUARY, 1854.

ART. I.—ON THE USES OF INDUSTRIAL EXHIBITIONS;—*The Great Industrial Exhibition of 1853, and its influence upon the Development of Industry in Ireland.* By SIR ROBERT KANE, F.R.S., M.R.I.A.

AT this time, when the impressions produced upon our minds by the beauty and splendour of the Great Industrial Exhibition are still so vivid, and that its well-merited success forms still the subject of hearty and universal congratulation, as well for the character of our country, as for the liberality of the eminent individual to whom its arrangements were chiefly due, it may not be considered out of place that we should endeavour to lead the public to bestow some thought upon what the Exhibition really signified, and avail ourselves of the interest with which all connected with it is invested, to refer to the practical uses which may be derived from such industrial demonstrations, and in fact to recall the attention of the public from the mere fact of the Exhibition to the objects which the Exhibition was founded to effect.

For we have full reason to believe that a very large proportion of the visitors to the Exhibition were led by previous habits, or by the architectural and artistic illusions of the scene, to regard the Exhibition rather as a show than as a study—to look upon it not so much as a lesson as a lounge—to consider it decidedly better to have the military bands in the building than in the square, where they should go away if it rained—and to regard the examining of the objects as a concentrated form of shopping, without any implied necessity to buy. But none of these constituted the object for which the Exhibition was opened. The opening of the Great Exhibition of last summer had for its aim the demonstration of the great industrial force which Ireland could bring forward at this time, and its comparison with the industrial capabilities and results of the sister kingdom, and of foreign countries, thereby that we might see palpably and impartially manifested wherein we may fairly and indisputably claim pre-eminence or credit, where we were powerless or incapable, and that by careful and accurate comparison of our own position as to materials and means, as to skill and taste, we might learn wherein lay our

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weakness, and where our strength, and make ourselves ready to apply our industrial energies to those branches that might be found especially adapted to the country, and to ourselves, and avoid wasting our exertions on subjects in which nature denies us success.

The best and highest object of the Exhibition was thus one of a practical and national character. There was necessarily associated therewith the very important object of showing to the public at large the great results of industrial invention, the triumphs of skill, and ingenuity, and taste—the highest points attained in ministering to material civilization in the several countries, which few can see, and which, even if seen isolatedly, cannot be appreciated, or their importance felt, as when aggregated in such a Grand Temple of Industry as the Exhibition formed. But naturally where the richest and most important manufactures of England, of France, of Germany, were displayed, the local element of the Exhibition became circumscribed, and to some extent overlaid, the more so as, from our industrial results being as yet but limited in variety and in extent, and also from a somewhat exaggerated spirit of hospitality, putting forward in all prominent places the productions of British and foreign contributors, rather than Irish works, the true amount and value of the products of our own country was not at first seen, and could not be fully appreciated by ordinary visitors. To those, however, who examined into the contents of the Exhibition with proper knowledge and care, the specially Irish portions, whether as raw materials or as finished productions, afforded satisfactory proof of the abundant means for industrial employment with which Providence has blessed our country, and of the capability of our people to carry out industrial pursuits, if properly directed.

It will be thus seen that we regard the object of the Exhibition to have been essentially that of instruction; and, in fact, we must consider all those accessories which distracted attention from that main and practical object to have been so far injurious to the proper object of the Exhibition. They were, of course, indispensable to its success and popularity under other points of view, and with the crowd, to whom purely instructional or useful objects are not congenial or attractive. Necessarily also in the classification and arrangement of such a gigantic aggregate of dissimilar things, hurriedly got together, and to be as hurriedly dispersed, the great condition of artistic grouping in effective masses predominated over the conditions of scientific arrangement; and the latter could only be observed as far as some general principles of distribution could be followed. This defect, inherent to the nature of so extensive, and so temporary an undertaking (and even more evident in the London Exhibition of 1851), is capable of being avoided only where an Exhibition is organized for purely instructional purposes; where the objects exhibited are admitted only as they serve that view, and where the permanence of the collections admits of such methodical and progressive arrangements as shall enable, not merely the actual condition, but the advance of every important branch of industry, to be shown. But precisely as in this manner the practical utility, as a means of instruction, of such an Exhibition would be enhanced, it might be feared that so would its popularity be diminished with the mass of the

uninstructed general public. The gigantic proportions—the architectural paradoxes—the gorgeous effect—the suddenness of creation, and the ephemeral existence, which rendered the visits to the Exhibition the social necessity and excitement of its day, being removed, it might be supposed, and with too much foundation, that the more solid, but unpretending, utilities, that had formed the groundwork of so much splendour, would, when left to themselves, be unable to awaken curiosity, or command attention.

It is, however, precisely in that point of view that we believe the results of the Great Exhibition to be likely to prove most useful. For the greatest difficulty previously had been to induce the general public to credit the necessity for instruction in industrial pursuits, to appreciate the vastness of industrial results, and to recognize the position due to the men who had placed themselves at the head of the industrial movement of the time. This difficulty will not, in future, be so insuperable. Even in England, so proud, and so justly proud, of her industrial power, it has been recognized that, to preserve, or to regain, her pre-eminence in many branches of trade, she must have artizans and employers of much higher and more cultivated intelligence than she now has, and that her educational means must be adapted in extent and character to the industrial wants of the present time. The real position of the industrial class in the State has also forced itself on the public mind in a very definite and positive manner; and the fact has become received that, by promoting and conducting great industrial undertakings, which diffuse comfort and contentment among the people—by fostering, in precept and example, the spirit of self-relying independence, of mutual charity and good will—one may render practical service to the State, and merit and obtain the highest and most public appreciation.

Thus the Great Exhibitions, by showing to the public, in a palpable and unmistakeable form, the grandeur and the complexity of industry, and by illustrating the amount of talent and knowledge necessary for its successful exercise, has paved the way for the organization of the means necessary for maintaining Great Britain in her proper place at the head of the World of Industry, and for even extending and perfecting, in every direction, the industrial forces which we now possess; and, as is usual, where a practical necessity is once felt, England is about meeting those exigencies in a great and proper manner; and there is very little doubt but that the steady and persevering energy which has enabled Great Britain to take the lead of Europe in so many practical matters, will enable her to become as successful in industrial education, now that she understands that she requires it as an instrument of practical success.

But all that has been said as to the necessity for education as an element of industrial success, and of the usefulness of exhibitions as a means of such education, applies even much more strongly to the circumstances of this country than of Great Britain. For in Great Britain, owing to the structure of its rocks, the coal and other materials for industry are diffused on so large a scale, and with such means for working, as to give it a natural supremacy in the most important branches of industry; and by

the long-established habits and system, and the enormous capitals of the industrial classes, its natural advantages have been most effectively applied. Hence, in England, even under the disadvantage of the want of industrial education, great means of practical success exist, and will continue to exist; but in a country such as Ireland, where hitherto manufacturing industry has been developed only in one or two departments, and even those not generally diffused—where the public mind has not been specially fixed on industrial pursuits as the most desirable career for the middle classes—where the natural resources, although rich and abundant, are not so glaringly favourable, at least as regards coal, as in England—and where there exists no prestige of established success to command acceptance in the market—there evidently an advance in industrial character and pursuits can only be attained by means of a thorough appreciation and employment of all those points in which we can equal or excel our neighbours, and by an equally perfect acquaintance with those matters in which the circumstances either of the country or of ourselves forbid us to hope for any successful competition. Thus the industrial future of Ireland, at least, must depend on the knowledge which her people will acquire of the resources at her disposal, and of the means by which those resources can be made the most of. But for this is required an exact and scientific, as well as a practical knowledge of the condition and appliances of analogous departments of industry in other countries, and, consequently, a well organized system of industrial education.

The popular exhibition, standing thus to the true educational museum nearly in the same relation as a popular lecture in science stands to sound systematic teaching, has admirably served its purpose of exciting attention, stimulating curiosity, and directing public opinion; but these effects would soon die away, and the most valuable results be lost, if, in its several aspects, it were not followed up by arrangements of a more permanent character. In this it is to be hoped that the various institutions which we already possess in Ireland will heartily co-operate, and that each, in its separate field, will not merely continue, but redouble its exertions, to promote the diffusion and enhance the character of industrial training in Ireland. For the great amount of good which may be done by our existing institutions will appear, to even a cursory survey of the portions of the general educational system already in action, disconnected and sometimes interfering as they are, and therefore destitute of the harmony and energy of action which full administrative unity would produce.

The progress of industry in Ireland will be found specially facilitated by the admirable training which the young people of the labouring and artisan class are now receiving in the primary National Schools. This education, it must be recollected, is not by any means confined to reading, writing, and arithmetic, but embraces by the lesson-books, and otherwise, the elements of natural and physical science, general notions of political economy, and other subjects of practical interest, together with (in the higher schools) the elements of drawing, of agriculture, and (for females) of embroidery. To this nothing exists equal in Great Britain, and scarcely in Europe;

and, moreover, in what are called the Model Schools, originally intended as model primary schools, but which have become really secondary schools of a very high class—as, for instance, in Clonmel, the instruction given furnishes the sons of the middle class with the best and most practical education that can be had anywhere for a mercantile career, where the parents do not propose putting the boy through a complete University course.

The facilities for imparting industrial instruction do not, however, cease with the primary or model schools: special provisions have been made in the constitution of the Queen's University, and of the colleges belonging to it, for providing, in two very important departments, the means of instruction, and of verifying proficiency by University examinations and diplomas. So far as these professional courses are concerned, a means exists, which can be developed hereafter to any necessary extent; and the important principle has been conceded, that the branches of industrial education may properly take their place in a University course, and rank together with the older and more established orders of University degrees.

There is still another means of industrial education already in some degree existing among us, and which, although not special to this country, like the institutions of the National Schools and Queen's University, but only here as a part of the general arrangements for the United Kingdom, is yet so fully in the spirit of our local ideas, and so much in harmony with our general tastes and tendencies, that it should promise, when well organised, to yield the most abundant and most profitable fruit. We refer to the means of education in industrial art—in design and decoration, in architecture, and finally, in all that range of subjects which extend from the purely intellectual conceptions of ideal art to the merely utilitarian construction of material. Few would be disposed to question the general diffusion among our people of an appreciation of artistic propriety—of taste in disposition of forms and arrangement of colours, which is not so generally found in the sister kingdom; and we have every hope that, by means of the Schools of Design already in action, and by such further development in that branch as may be found expedient, our national capabilities may be rendered fully available for advancement in the various departments of industry in which a large proportion of the value of the product depends upon the artistic excellence of its design, in construction or decoration, in form or colour. And if we run our eye over any catalogue of industrial objects, we shall find that, by this one department of education alone, a means of honourable and remunerative employment of a very high character, would be opened to our artizan and middle class, to an almost unlimited extent.

In addition to those means of instruction which, extending through the country at large, and to be regarded, although collaterally, of great value for industrial objects, are so principally by their action on general education, and by, therefore, preparing the soil for more special and deeper cultivation, we have in the metropolis of Ireland also institutions which have borne excellent fruit, and have exercised no slight influence on the industrial position to which Ireland has already, even under so very many disadvantages, attained, and

from which may be expected, in their several departments, even still more beneficial results. The industrial and artistic spirit which, paralyzed for so many years by the absorption of all public energy, and public attention, in the chaos of abstract political debate, had almost totally died out, was in a material degree preserved, and prepared for its invigorated revival, by the popular exhibitions which, from time to time, were held by the Royal Dublin Society. In the same institution also considerable energy has been displayed in the organization of a museum of agricultural objects, whilst the illustration of the natural sciences in the Museum of Natural History, and in the Botanic Garden (as well by its beauty as its associations, one of the chief ornaments of Dublin), has constituted perhaps the most popular and entertaining department of its labours.

To the Museum of Industry, founded by Her Majesty's Government in Dublin for special educational objects in all the various departments of industry, &c., and in which that permanent and legitimate exposition of industrial objects is to be carried out, which we referred to in the commencement as the indispensable corollary and sequel to popular exhibitions, we shall not here more particularly refer than to state, as we have done regarding our other educational establishments, the desirability of such development as will secure that the proper objects shall be efficiently carried out, and the imperative necessity for hearty and mutual co-operation on the part of every institution, and every person engaged in this great and beneficial work. And it is fortunate for the industrial and educational progress of the country that the public importance of the subject has made itself so sensibly felt, that a new department of the Government has been formed for the special administration of those branches of the public service under the Board of Trade. We may hence have every hope that whilst the unity and responsibility of control indispensable in the management of institutions supported either wholly or partially from the public funds, may be steadily maintained, there may be expected to result for the special institutions of all classes engaged in the work of industrial education more useful co-operation among themselves—a more sustained energy in their action, and greater efficiency and influence in their results, whereby will naturally result a more just and more general appreciation by the public of the actual excellencies of each, and a more certain recognition and reward to those who have been the agents of success, and who are entitled to the fair rewards of their honourable exertions.

ART. II.—THE UNDEVELOPED RESOURCES OF IRELAND, No I.—*On the Application of Fish Offal and Marine Exuvie to the Manufacture of Artificial Manure.* BY WILLIAM K. SULLIVAN.

AN opinion has latterly been gaining ground, that ammonia, or substances which yield it by decomposition, is a far more important element of manures than the mineral ingredients; nay more, that the nitrogenous element alone is of importance, and that the other constituents, with perhaps the exception of phosphoric acid, may, to a great extent, be dispensed with. Without going this length, or indeed entering upon such theoretical considerations at all, there now exists no doubt that ammonia, in some form, especially at the moment when it is disengaged from decomposing animal substances, is one of the most efficacious means of increasing the gross weight of a crop, as well as of improving its quality. If proof were required, we would certainly have it in the enormous quantities of guano which are every year introduced into these countries. Every island on the coasts of Africa and America has been ransacked, and the accumulated deposits of ages borne away in a few months, by fleets of vessels, whose united tonnage was equal to the mercantile navies of many considerable states. The supplies of this valuable substance are gradually becoming scarcer; and, even if a supply could now be had equal to the maximum importation of a few years since—which may be taken at about 200,000 tons, value perhaps one million and a half sterling—it cannot be considered a good principle to seek for the means of renewing the fertility of our soil in distant regions of the earth, until we have exhausted all our home resources. The beautiful researches of the French chemist Balard have already opened up a new field in the ocean for supplying potash to our manufactures, which had already begun to feel a scarcity of that article, from the rapid destruction of the forests of America and Russia, and the gradually increasing demand for it. May not the ocean also supply us with a substitute for guano? Undoubtedly it may; and one, too, to the supply of which there may be said to be no limit—and that substitute is Fish.

Whenever extraordinary shoals of fish have visited our coasts, the superfluous portion, which could not be consumed as food, has been employed to manure patches of land, and always with the best results; and the offal of curing-houses, in all countries, is applied to the same purpose. The supply thus obtained is, however, very trifling and variable. In all those cases, too, the fish is employed in its natural state; but it is evident that, however large the supply might be, it is only some small tracts along the coasts which could be benefited by fish manure, unless we could convert it into a portable substance, which might be kept until it was required for use. The conditions which require to be fulfilled in order that the manufacture of such an article be successful, are the following:—1. That fish contain in abundance those elements which are now considered most important for the growth of plants; 2. That the process of producing the manure be simple and inexpensive; 3. That an abundant supply of raw material be always to be had, and at a sufficiently moderate price. The

object of the present paper, then, is to examine how far the fulfilment of these conditions is practicable. We shall therefore, in the first place, consider the first condition—Does fish contain the elements of a valuable manure?

Animals consist essentially of four classes of substances:—water; fats or oils; earthy, or mineral, ingredients abounding most in the skeleton; and a series of bodies, very analogous in composition, containing nitrogen, and capable, under certain conditions, of giving off this nitrogen in the form of ammonia, one of those conditions being putrefaction. In animal matter, in its natural condition, the water forms by far the largest part; the proportion, however, varies within certain limits, being sometimes so high as 75 per cent., and in other cases so low as 64 or 65 per cent. The oil or fat is also very variable, forming but a very small proportion in some animals, whilst in some fishes it not unfrequently constitutes one-fifth of the whole mass. It even varies at different ages, at different seasons, and under different circumstances; thus eels, sprats, and herrings are very rich in oil in the commencement of their respective seasons, whilst towards the end of it they yield but little. There is also considerable variations in the amount of mineral ingredients, depending upon the size of the skeleton, and even upon the materials of which it is composed; for all skeletons are not equally rich in bone earth—the cartilaginous fishes, such as the various kinds of shark, angel fish, dog fish, &c., containing very little. It is unnecessary to add that the fourth class of substances must vary similarly. As our present object has reference to fish only, we shall confine our remarks to that kind of animal matter. Unfortunately there have been but few analyses of entire fishes made from this point of view; indeed, we can only refer to those of sprats, made by Professor Way, and those of herrings by ourselves, the results of which are contained in the following table:—

	Sprats of 1847.	Sprats of 1850.	Herrings.
Water	64·60	63·65	67·447
Oil	19·50	18·60	13·770
Dry nitrogenous matter	13·78	15·65	16·375
Ash	2·12	2·10	2·408
	<hr/> 100·00	<hr/> 100·00	<hr/> 100·000

As the value of any manure can only depend upon the quantity of solid matter which it would yield when perfectly dried, we need not take the amount of water in the preceding estimate into account. The valuable portion of a mass of fish will therefore consist of oil, nitrogenous matter, and ash, or mineral matter. Oil is a very questionable manure, notwithstanding the opinions quoted by Professor Johnston, in his *Lectures on Agricultural Chemistry*, which tend to show, that coarse fish oil, when employed as a compost with earth and wood ashes, or when employed with bones and pigeons' dung, increased the gross weight of the turnip crop. From the loose way in which agricultural experiments are usually conducted, much reliance cannot be placed upon such statements. Oil is, however, a very valuable substance, and there is an almost unlimited demand for it, for other purposes than for manure. In the manufacture of

a portable manure, the oil should therefore be removed, and would, in the case of herrings, sprats, and other oily fish, form a very valuable item. The parts of the fish which could be used, therefore, as manure, would be the nitrogenous matter, and the ash or mineral ingredients, the chemical nature of which we shall now consider.

The constitution of that part of the fish which we have termed nitrogenous matter, and which consists of the muscular and cellular tissues—the whole framework, in fact, of the animal—is practically the same as that of the flesh of the mammalian animals. It consists, like it, of four elements, one of which is nitrogen. This element is eliminated, during the putrefaction of animal substances, in the form of ammonia, which, as our readers will have gathered from our previous observations, is perhaps the most important substance required for the food of plants. To judge, therefore, of the value of the nitrogenous part of fish, we should know the quantity of nitrogen which it contains; and from this, by a simple calculation, we can deduce the quantity of ammonia which it will yield. According to the analyses of Schlossberger and Kemp, the dried residue of the fishes examined by them contained the following per-centage of nitrogen:—

Herring . . .	14.48	Flounder . . .	14.28
Haddock . . .	14.64	Skate . . .	15.39

According to Way, the same part of the sprat contained 11.53 per cent.; and my own analyses of the nitrogenous part of the herring gave 14.740, or about the same as that found by Schlossberger and Kemp. These results would correspond to 1.94 per cent. of nitrogen in raw sprats, and to 2.768 in raw herrings.

The skeletons of fish, like those of the higher order of animals, contain a very large proportion of bone earth, or phosphate of lime, and hence that substance must form a very important element of the ash left on incinerating a mass of dried fish; because the mineral ingredients contained in the soft parts of the animal bear but a small proportion to the whole mass contained in some skeletons. Accordingly, Way found that the ash of the sprat of 1847 contained 43.52 per cent., and those of 1848, 40.49 per cent. of phosphoric acid; and I found in that of herrings 46.817. The whole of this phosphoric acid did not, however, exist in the fish as bone earth, part of it being present, as phosphate of soda, in the blood, and as phosphate of potash in the juices of the flesh. A certain portion of phosphorus is also found, in other states of combination, in fish, but, its quantity, being small, may be neglected here. Next to ammonia, phosphoric acid appears to be the substance, which experience has established, to have most effect as a manure; the mineral constituents of fish must therefore be of great value, from the quantity of phosphoric acid existing in them. Next in the order of importance to phosphoric acid as a manure comes potash; and as that substance is found in plants, combined to a large extent with potash, the phosphate of potash existing in fish would undoubtedly constitute one of the most active ingredients in a manure made with fish. The phosphates would, however, form one of the most variable elements of such a manure, for the reasons already stated; and

especially where the offal of curing-houses, or the soft marine animals, such as the star-fish, medusæ, cephalopoda, &c., would enter to any great extent into its composition.

Like all other manures, that made from fish would therefore vary to a certain extent; but, bearing this in mind, we may for our present object take, as the type of the most superior kind, that which could be produced from herrings. Basing our calculations upon the analysis given above, we shall suppose 100 tons to be boiled up, so as to separate the whole of the oil, and that the residual matter was dried down, so as to form a solid mass containing about 10 per cent. of water, we would have 20·659 tons of solid manure, and 13·77 tons of oil. The composition of this manure would be represented thus:—

Water	.	.	.	.	.	.	10·000
Animal matter	.	.	.	.	.	.	78·342
Ash	.	.	.	.	.	.	11·658
							<hr/>
							100·000

This animal matter would contain 13·398 parts of nitrogen, which by its decomposition would yield 16·266 parts of ammonia. Of the ash, 5·457 would be phosphoric acid, a quantity which would be equivalent to 11·171 of bone earth.

To understand the value of these numbers, it is necessary to compare them with the results of the analyses of some manures, the commercial value of which is well understood, such as guano. It being, however, a substance of very variable composition, even when taken from the same mass, we can only compare the average composition as deduced from a great number of analyses. The following are the mean results of a great number of such determinations made by Professor Way, Dr. Ure, and Mr. Teschemacher, and collected by the former gentleman, in his very admirable paper in the *Journal of the Royal Agricultural Society of England*, for July, 1849:—

Varieties of guano.	Number of specimens examined.	Per-centage of ammonia.	Per-centage of bone earth.
Peruvian	32	17·41	24·12
Ichaboe	11	7·30	30·30
Patagonian	14	2·54	44·60
Saldaña Bay	20	1·62	56·40

In comparing these numbers with those representing the composition of the fish, we find that one ton of the dried matter of the latter would be capable of yielding nearly as much ammonia as one ton of Peruvian guano, and double as much as Ichaboe—the fish manure giving not quite half the amount of bone earth in the former guano, and but little more than one-third of that in the latter. To form a just comparison between dried fish and guano, we must take into account the fact, that a large part of the nitrogen existing in the latter is already in the state of ammonia; whilst in the fish manure there would be no ready-formed ammonia. In all cases, therefore, where it would be desirable to have a manure produce immediate effect, guano would be superior to fish manure; but the latter, producing ammonia only by slow decomposition, would be preferable where

a permanent improvement of the soil would be the object. For the same reasons, fish manure would be better adapted to light sandy soils, deficient in those peculiar silicates, which Professor Way has shown to be so indispensable an ingredient of soils, as absorbents of ammonia. Rich cultivated clay soils abound in them; and hence, when guano is applied to land of this description, the soil is capable of appropriating the whole of the free ammonia in the manure. But light arenaceous soils, under the same circumstances, would not be able to do so to the same extent, and a part of it might consequently be lost; fish manure, on the other hand, would give off its ammonia so slowly that the soil would always be in a fit condition to take it up as rapidly as it would be formed. Although we have stated this objection, which, in the absence of decisive experiments, might be reasonably urged, we do not believe it would materially affect the value of fish as a manure—a point which we believe to have established in the preceding observations.

The second question to be considered is, whether a portable manure, possessing the valuable properties of fish, could be made from it by some simple process? Before answering this question, it may perhaps be desirable to notice the attempts formerly made in this direction. So early as 1672, a company was formed in France, under the auspices of Colbert, to which great privileges were accorded, for the manufacture of fish oil. That company had stations at Dieppe, Fecamp, and Sainte Valery, and curiously enough, it was proposed to convert the residue left after the extraction of the oil into a manure. The advantages promised were not, however, realised, and in a short time the company disappeared; but the remembrance of its ill success remained to prevent what was good in the project from being carried out, and accordingly the idea was barren. In 1750, a Swedish nobleman, named Calman, struck with the advantages which the manufacture of the oil of herrings, which he had seen a person of the name of Bauer prepare for his own use, would be likely to confer upon the fisheries of his country, spared no expense or trouble to establish it. At first only the gills, intestines, and other offal obtained in curing the herrings, were employed; but the oil thus prepared having found a ready market, and immense numbers of herrings frequenting, at that time, the coasts of Sweden, it was decided, in 1776, to boil the entire fish. The new manufacture having proved successful, the number of boiling-houses increased, so that already, in 1783, there were more than 200 established on the rocks bordering the coast between Gothenburg and Stramstadt. Some idea may be formed of the extent of the trade, when it is stated that, in 1781, the total quantity of herrings taken amounted to about 400,000 tons; of which 136,649 barrels, of 1200 each, were exported, as cured herrings, to the Mediterranean, Madeira, &c., the greater part of the remainder having been boiled down for oil.

The process employed to extract the oil of herrings was exceedingly simple. The fish were boiled during five or six hours in large copper caldrons, with constant stirring, until they were reduced to a kind of paste; after which the fire was extinguished, some cold water added, and the whole allowed to rest for two or three hours. The oil which floated to

the surface was removed, filtered through woollen bags, allowed to deposit any suspended matter, and again filtered and barrelled. If the boiling had been carried on too long, the oil was found to be more or less brown; when properly done, however, it was limpid, colourless, and in large quantity, like good olive oil.* The mass remaining in the boiling-pans was called by the Swedes *trangrum*, and was considered by them an excellent manure, for which purpose it was used along the coast. The greater part of it was, however, at first thrown into the sea, because, independent of the fact that the true value of artificial manure was not then understood, it would not pay to transport it inland, from the condition of the roads. Shortly after 1783, the herrings began to diminish on the coast of Sweden, owing to the mode in which they were caught. The whole western coasts of Sweden and Norway are deeply indented with fiords or creeks, into which the herrings swarmed as into a bag, and where the whole mass was taken by barring the mouth with a great net. The fishermen, however, did not attribute the departure of the herrings from their coast to the real cause, but decided that it must be the *trangrum* thrown into the sea. Accordingly, the Government, influenced by the continual complaints, directed that it should be removed inland and buried. The great expense of this operation—of which we may judge when it is told that 30,000 tons of *trangrum* were annually buried—added to the gradual diminution of the shoals of herrings, gave a final blow to the manufacture; so that, in 1799, the herring fishery scarcely supplied the home demand for cured fish, and the exportation was forbidden; in 1800, there was an importation from Scotland, which continues still. The manufacture of herring oil was not, however, at any time completely extinct in Sweden; the *trangrum* resulting from the little that is prepared is used as a manure, sometimes mixed with clay, and sometimes with charred sea-weed.

Many years ago, Noël de la Morinière suggested the idea of building large vessels, and sending them to the fishing grounds, provided with boiling pans, by which large quantities of oil could be prepared, at the same time that the whole of the *trangrum* might be brought back, and employed as we now use guano. M. Valenciennes, the distinguished naturalist, who mentions this proposition of De la Morinière, records his opinion in its favour. So also does another competent authority, M. Quatrefages, who recommends that the *trangrum* should be pressed, to get rid of the liquid portion, and the solid cakes dried in a current of air produced by the same fire used in heating the boiling coppers. We are also aware of some trials which have been made in Holland to prepare a portable manure from fish, but cannot speak of its success. In England, also, several patents have been taken out for the same purpose, but, from some cause or other, have not been successful. About four years ago a process was mentioned to us to convert waste fish into a sort of guano, which consisted in boiling the fish in a pan with some sulphuric acid, and separating the oil which floated

* Sur la fabrication de l'huile de hareng à la manière des Suédois—Memoire inédit de Noël de la Morinière—quoted in the *Histoire Naturelle du Hareng*, par M. Valenciennes (forming part of vol. xx. de l'*Histoire Naturelle des Poissons*, par MM. G. Cuvier et A. Valenciennes).

on the surface, pressing the residue so as to obtain it in the form of cakes, or adding lime to neutralise the acid and absorb the water, and then fully drying the resulting mass in a current of hot air. Charred peat and charred sea-weed were also employed, and even burnt clay. Many of our readers will perceive that this is identically the same process as that recently patented by another person, and of which we shall have occasion to speak subsequently. Any of these processes is exceedingly simple; so much so, indeed, that a capital of a few hundred pounds would be quite sufficient to enable a person of energy to set up a small factory, and manufacture the manure.

At the time the process above mentioned was brought under our notice, we obtained some samples of the manure made by it, which were analysed. We shall give here the results of our examination:—

Composition of Fish manure.			
	No. 1.	No. 2.	
Water	8.844	10.147	
Animal matter	53.270	69.704	
Ash	37.886	13.627	
Oil	—	6.522	
	100.00	100.00	

The ash of No. 1, which was made from fish offal, contained 8.036 per cent. of phosphoric acid, which would represent 3.044 per cent. in the manure, which in its natural state contained 6.452 per cent. of nitrogen. This sample was made by absorbing the liquid with lime; hence the large percentage of ash. The ash of No. 2, which was made from sprats by simply pressing the mass formed by the action of sulphuric acid upon the fish, and air drying it, contained 31.804 per cent. of phosphoric acid, equivalent to 4.333 per cent in the manure; and the animal matter contained in its natural state 10.697 per cent. of nitrogen. Judging these specimens by the same standard which we have already applied to guano, the available ammonia and bone earth would be as follow:—

	No. 1.	No. 2.
Ammonia	7.832	12.985
Bone earth	6.230	8.871

Several samples of the substance known as "Pettitt's guano" have been analysed by Professor Way and Mr. Louis Thompson; and as this substance is a fish manure, made by exactly the same process as the specimen just mentioned, we shall quote the results obtained in one or two cases, by way of comparison to our own. No. 1 was analysed by Way, and No. 2 by Thompson:—

No. 1.		No. 2.	
Water	4.93	Organic matter	85.73
Oil	3.42	Ash	10.72
Organic matter and salts of ammonia	84.94	Water	3.55
Sand, &c.	1.35		100.00
Phosphate of lime	0.39		
Phosphate of potash and soda, with a little chloride of sodium	3.67		
Sulphates of potash and soda	1.30		
	100.00		

The quantities of ammonia and bone earth which these two specimens would be capable of yielding, may be represented by the following numbers:—

	No. 1.	No. 2.
Ammonia . . .	16.78 per cent.	11.73 per cent.
Bone earth . . .	3.36 „	9.25 „

The quantity of ammonia in No. 1 approaches so near the theoretic quantity already calculated for manure made from herrings, and the large quantity of alkaline salts which it contained, lead us to the conclusion that the boiled fish was simply dried down, and not pressed; for otherwise the greater part of the soluble salts would be removed in the liquid pressed out, a large part of the phosphoric acid would also be lost; the small per-centage of the latter substance is, however, against this view; whilst No. 2, on the contrary, appears to have been pressed. The first was probably made from herrings, and the second from sprats; and will therefore represent, the former, the dried herring manure already mentioned, and the latter, the sprat manure analysed by ourselves.

Perhaps the best way of judging of the value of a manure is to submit it to a money test. The usual method adopted in the case of guano is to calculate the number of pounds of ammonia and of bone earth which they would yield, and to estimate the former at sixpence per pound, which is about the usual commercial price of that substance in the condition of sulphate of ammonia, and the bone earth at three farthings per pound. In order that the reader may have a clear idea of the relative values of guano and fish manure, we shall give, in the following table, an estimate founded upon the amount of ammonia and bone earth in each of the principal guanos which are known in commerce, deduced from the average results of the analyses of those articles already given; and also the quantities contained in the samples of fish manure which we have ourselves analysed, calculated upon the basis just assumed:—

Value per ton, assuming the whole of the nitrogen to produce ammonia worth 6d. per lb., and the whole of the phosphoric acid to be bone earth, worth ¼d. per lb.

	£	s.	d.
Peruvian guano	11	7	9
Ichaboe	6	4	1½
Patagonian	4	10	9½
Saldanha Bay	4	17	0½
Manure from dried herrings after separation of oil	9	17	9½
Manure from fish offal, made with sulphuric acid and lime	4	16	5½
Manure from sprats, made with sulphuric acid and simple pressure	7	17	9

The specimens of Pettitt's guano, analysed by Professor Way, would have about the value of the dried herrings; and that analysed by Thompson would perhaps be worth the same as that from sprats.

Assuming that we have established the facts, that fish contains all the elements which constitute a manure similar to guano, and that it may be readily converted into such substance by simple means, we have next to see what would be the probable expense of producing one ton of the manure. One of the chief elements in the cost of production of such an

article would undoubtedly be the price of the raw material, and this would to a great extent depend on the supply. According to a little pamphlet, which accompanied a sample of fish manure placed in the Dublin Exhibition, two tons of fish are assumed to produce one ton of manure. If our readers will refer to our previous observations, and especially to the analyses of herrings and sprats, they will find that raw fish contains nearly 70 per cent. of water; or, taking herrings as the type, we have, in round numbers, 67 per cent. of water. Now two tons of herrings dried into one ton of manure, would, it appears to us, contain $33\frac{1}{2}$ per cent. of water; but the analyses quoted in the same pamphlet, in the table where the fish manure is compared with guano, represent the former article as containing very little water—in one case, indeed, none at all—the highest being 4.93 per cent. It is quite clear, therefore, that two tons of fish would not produce one ton of a manure equal to guano. There is another fact, too, which we must remember—namely, that if oily fish be employed to make manure, without separating the oil, the quantity of ammonia which a ton of the manufactured article would be capable of yielding, and, we may add, of phosphoric acid and potash also, would be diminished in direct proportion to the amount of oil in the fish. To make the matter more intelligible, we shall select an example. One ton of the sprats of 1848 would consist of 1425 lbs. of water (rejecting the fractions of a pound), and 815 lbs. of solid matter, of which there would be 416 lbs. of oil and 399 lbs. of animal matter. Now, if we suppose two tons of such fish to be dried into one ton, the resulting mass would consist of 832 lbs. of oil, 610 lbs. of water, and 798 lbs. of solid matter. The oil and water could scarcely be considered of value for the food of plants, so that the part of such an article which would possess real manuring properties would form little more than 34 per cent. of the whole. One ton of such a manure would be capable of yielding about 87 lbs. of ammonia, and about 83 lbs. of bone earth; calculating the former at sixpence per lb., and the latter at three farthings, the commercial value of such a manure would be only £2 8s. 8½d. Now, according to the pamphlet, which is, in fact, a sort of prospectus of an embryo company, the raw material of the one ton of manure would cost £4; so that the net “profit” of the manufacturers, exclusive of the cost of manufacture and other items, would be a *loss* of £1 11s. 3¾d.

In the manufacture of fish manure, the oil should always be separated, because it is much more valuable as oil than as manure. Deducting this constituent, therefore, whenever it may occur, it would require *four and a half to five tons of raw fish to produce one ton* of a manure equal to the average specimen of Peruvian guano. For example, 100 tons of herrings, having the composition shown by the analysis given above, would yield a little more than $20\frac{1}{2}$ tons of a manure containing 10 per cent. of water, or about one ton for every five of fish; and supposing the whole of the oil extracted a little over 12 tons of 252 gallons of fish oil. The manure thus made would be fully worth £8 per ton; and if we assume the produce of the oil to be only 10 tons, the value of the manufactured articles from 100 tons of good herrings, would be, in round numbers—

	£	s.	d.
20 tons of fish manure, at £8 per ton	160	0	0
10 tons of fish oil, at £29 10s. per tun	295	0	0
	<hr/>		
	£455	0	0

or £4 11s. per ton of herrings. This sum would enable a manufacturer to pay £2 per ton for his herrings, and allowing £1 for manufacturing expenses, wear and tear, &c., would leave a profit of £2 1s. per ton of herrings employed. The oil contained in fish, being, however, variable, diminishing as the season advances, the average profit for an entire season would be much less; perhaps not more than £1 could be realised in general, which would still be a handsome profit.

If, however, the fish employed contained little or no oil, the produce of 100 tons would not give more than £1 12s. per ton of fish, to cover the cost of raw material, fuel, labour, &c. Scarcely any fish, however, is completely devoid of oil, so that we may always consider that 100 tons of it would contain oil enough to pay for the expense of manufacture. Allowing 10s. per ton of fish as profit, which would be £2 10s. per ton of manure, a manufacturer could not, therefore, afford more than 22s. per ton for his raw material; but with a profit of only 4s. per ton of fish, or £1 per ton of manure, he might be able to pay £1 8s. for it. But could he get herrings at £2 per ton, and waste fish, not rich in oil, at say £1 per ton? This, after all, is the chief point to be decided. In the neighbourhood of the herring fishing stations, a considerable quantity of offal, consisting of the gills, intestines, &c., could be had—every fourteen barrels of fish giving one of offal—and quantities of the herrings themselves might occasionally be obtained at that price. Another source of supply would be the coarse fish, such as conger, skate, dog fish, &c., which at present is generally thrown into the sea, when drawn in by the lines or nets, but which would be all brought ashore if there was a market for it.

During the herring season, on the western coast of Ireland, one hundred herrings, of six score, can be purchased for sixpence. A ton of good medium sized herrings would consist of about 5600 fish, which would give a little more than six ounces for each fish in its fresh state; at the price just named, therefore, one ton of herrings could be purchased at about £1 3s. 3d. A barrel of medium sized herrings usually contains about six hundred fish, hence one ton would give about eight barrels, and 100 tons, 800 barrels, which could be sold at 15s. per barrel, at least. Now, let us see what would be the relative value of 100 tons of herrings cured, and the same quantity converted into oil and manure:—

	£	s.	d.
100 tons of herrings, supposed to yield 800 barrels of cured fish, at 15s. per barrel	600	0	0
100 tons of herrings, converted into oil and manure as already stated	455	0	0
	<hr/>		
Difference in favour of cured fish	£145	0	0

We need scarcely tell our readers that the expense of curing one ton of herrings would not exceed, if indeed it would equal, that of converting

them into manure. If these numbers are correct, and there is no doubt that they are at least approximately so, two facts will have been established—namely, that superior fish, like herrings, can be procured on the coasts at a sum under £2 per ton; but as there would be a larger profit derived from curing them than converting them into manure, we do not conceive that it would be an improvement to make the latter, whilst our fisheries are as yet unable to supply the demand for cured fish.

There remains now to consider the other source of supply—coarse fish and fish offal. If herrings can be sold, during the season, at the low price above stated—and we have known them to be sold at much less—there can be no reason to doubt that dog fish, the carcasses of the sun fish, &c., could be had for £1 per ton, and even less. But what quantity of this offal could be had? For it is evidently of little consequence for our purpose if we could obtain herring offal or coarse fish for 5s. per ton, unless the supply was such as would render the manufacture of a manure possible. The answer to this question depends entirely upon the mode in which such a branch of trade would be carried on. If by an individual, we are confident that enough could be obtained at the principal fishing stations around all the coasts of Great Britain and Ireland to give rise to a valuable branch of manufacture. If, on the other hand, it is attempted by a great joint-stock company, the supply would not be sufficient for the scale upon which their operations should be conducted.

We believe that the quantity of waste fish, animal offal, &c., which the largest of the fishing stations in Ireland could supply, would not be equal to 100 tons per week during the fishing season, and would not perhaps be five tons for the smaller. A man might carry on a small manufacture with from 10 to 20 tons a week; but we believe that we need not tell our readers that a joint-stock company is not the sort of thing adapted to work 100 small factories scattered along the coast, the average annual profit of each of which would not exceed £100 or £500—a sum which would be a handsome income to an individual who would give his whole time to it; but which would scarcely cover the expense of local management, not to speak of town offices, directors' salaries, &c., of a large company.

There seems to be a strange mania for inventing new modes of treatment for the diseases, moral and physical, under which Ireland suffers. Not a week but some new specific is announced. Sometimes it is of a religious character, sometimes political, and sometimes industrial. The public is much better acquainted with the two former systems than with the latter, a systematic classification of which is most desirable. We hope some of our kind medical critics will take the subject in hand, and supply us with a good treatise thereon. Such a book would be both curious and interesting, and would show, in a most striking manner, the effects of imagination in the cure of disease, a point not sufficiently dwelt upon hitherto, but which forms the characteristic feature of the industrial system of treatment. Thus it would show us how our turf-bogs, which have been in a state of chronic growth since the deluge, could, in a few years, be converted into smiling fields; how our fleets of fishing-boats, if we had them, would catch shoals of fish, which now disdain to come near our

coasts, because we have not the means of catching them; and, finally, how our granite and other rocks, under the magic power of a board of M.D.s, otherwise mining directors, might be converted into rich veins of copper and lead ore. Irishmen can only lay claim to the invention of the political systems of treatment, and perhaps in part to the religious ones; but the honour of having discovered the industrial systems belongs almost exclusively to our neighbours, and especially to the Metropolitan School of London.

As, however, there is nothing new under the sun, so, in many cases our industrial friends merely reinvent an old remedy; but then they make a *patent medicine* of their nostrum, which of course gives it the brand of "genuine." It is in this way that fish manure, which is so long known, has been rebaptised as "National Fisheries guano," and a perfect jubilation raised about the wonders it is destined to work. The Atlantic Ocean is to be sifted, and all the inhabitants of the Great Deep are to be powdered by patent, and the very rocks made to produce a crop under the potent influence of this powder. And as the Government, notwithstanding what they spent in encouraging the Irish fisheries, cannot, according to the proprietor of the aforesaid patent medicine, supply the population with money to purchase the fish, when caught, an amelioration society, vulgarly called a Fishing Guano Company, will assist us with a sum of £100,000, and if that will not do, with £250,000. There is nothing like a name, so here is an idea for some person: let him make fish broth, and call it *liquid manure*, take out a patent, get up a company with a *capital of one million*, in any number of shares, and then sprinkle his beneficial soup over the country. If any one will take up this new idea, he may have it gratis.

In the meantime, while these great projects are being prepared, and for the preparation of which we can well wait, we are anxious to direct the serious attention of the public to the few facts which we have endeavoured to bring before them in the preceding pages. We have endeavoured to show that fish contains the elements of an excellent manure; that a portable material, possessing all the properties of the fish unimpaired, can be made from it; and that, under favourable conditions, and carried on by individual enterprise, there is a wide and profitable field opened to small capitalists. At present there is no impediment to any man trying the experiment; for even if the patent right of the embryo company be valid, which we have reason to believe it is not, it only applies to the peculiar process proposed, and the same result might be arrived at in fifty different ways. The introduction of such a branch of manufacture, if properly carried out, would do much to develop the fishing trade of this country, and render, what is now one of the most precarious means of existence, at once prosperous and certain.

In intimate connexion with the subject which we have here discussed, there is another, which is of immense importance to all maritime countries. Why not, for example, adopt the great idea of M. Quatrefages, and *sow the ocean with fish as we sow the land with grain*. With the experience of France upon the artificial breeding of fresh-water fish, and the successful experiments exhibited in the Dublin Exposition, by the Commissioners of

Fisheries, what is to prevent our artificially fecundating some millions of eggs of the herring, pilchard, cod, &c., in great fish-ponds, formed of creeks along our indented coasts, and thus at once provide food for the people and manure for the enrichment of the land. However preposterous the idea may at first appear, it is not more so than many others which have been realised in our days. When we recollect the enormous fecundity of the herring and other fish—one thousand females being quite sufficient to people our seas—the probability of fecundating eggs enough to produce ten millions in each of twenty creeks, where fishing would be strictly prohibited, becomes a mere question of experience. Ten millions of herrings would give about 1800 to 2000 tons of fish, or about 14,000 barrels. Here, therefore, are two great sources of industry open, not alone to Ireland, but to Great Britain also. Who will be the pioneer?

ART. III.—*Comptes Rendus of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c. and of Discoveries in general science bearing upon Industrial Arts.*

M. Bérard's Machine for Sifting Coal.—Although the system of washing coal to separate schist and pyrites, invented by M. Bérard, has been in use in France for the last five or six years, and has also been for some time employed near Newcastle-upon-Tyne, we believe we shall be doing good service by bringing it more prominently under the notice of the Irish public. Nearly all our seams of coal are exceedingly thin, and with the most careful working considerable quantities of shale get mixed up with the coal, thereby lowering very much its value, and even in many cases rendering it all but impossible to coke it. A good deal of pyrites is also found disseminated through many seams of, otherwise, excellent quality, especially in the Tyrone coal field. The presence of pyrites, as is well known, renders it very unfit for many purposes, such as the manufacture of iron; and the coke made from it, when employed in locomotives, rapidly destroys the boilers. Many attempts had been previously made to purify the coal of such thin seams, but with little result, the quantities capable of being cleaned in a given time being small, and the expense very great. By one of M. Bérard's machines, however, costing about £400, ten to twelve metrical tons (nearly equal to the same number of English tons) can be cleaned in an hour, or from 120 to 140 tons per day, at an expense of about 10 to 12 centimes per ton, or only about one penny! The quantity of water required to work such a machine is also remarkably small, being only about 2,000 gallons per day, a fact which very considerably increases the value of the process. It would be impossible to exaggerate the importance of this invention to our Irish collieries—it is, in fact, our great desideratum, and it is only surprising that it has not long since been introduced here.

We extract the following description of the machine from the reports of the Juries of the Great Exhibition of 1851, at which M. Bérard received the award of a council medal.

The apparatus consists of three parts, viz. :

1. An *Elevator*, formed of an endless chain with buckets which lift from a trough or pit where the coals are placed, a certain quantity regulated by means of a valve.

2. A *Separator*, into which the fuel is thrown by the elevator. This is composed of a long box divided into compartments, and containing perforated plates in stages, the size of the perforations being smaller and smaller by stages from the

upper to the lower, so that by the shaking which this box undergoes the coal is at once divided into four sizes. The finest powder falls to the bottom, and each of the three sizes of lumps being thrown out through openings in the sides of the box into separate fixed sides, called "*bancs à lavage*," which form the third part of the apparatus.

3. These "*bancs à lavage*" are long frames, measuring 9 feet 2 inches, by 4 feet, of which the bottoms are pierced with holes, the diameter of which is smaller than that of the pieces of coal thrown into them. They are entirely filled with water, and divided in the interior into three parts. In one of these is a piston, which is worked up and down, and gives considerable motion to the water, which being communicated to the materials thrown on the bottom of the tank, these arrange themselves rapidly in the order of their density, the heaviest being at the bottom; the pure coal alone comes to the surface, and by a current of water proceeding from a trough above, it is carried beyond the tank, and falls directly into the waggon, whence it is conveyed to its destination. The substances heavier than coal, such as schist or pyrites, are deposited in the perforated bottom of the tank, which has a slight inclination towards a trap, and thus constantly advances towards an exit. By a peculiar arrangement the rubbish is thus made to carry itself into a compartment prepared in the inside of the tank, where it is removed by the mere opening of a valve.

It will be seen from this description that the work is continuous throughout, and requires no manual assistance. The invention is patented in France, Belgium, Germany, and England, but, we believe, not in Ireland. M. Bérard's address is 44, Rue Blanche, Paris.

There can be no doubt that even the ordinary coals used for making coke upon railways might be passed through this machine with great advantage, as the experience of the Great Northern Railway of France shows; that company having found a great economy of fuel and a greater durability of their locomotives' boilers, by using washed coal. Indeed it is unnecessary to say more than that coal yielding 26 per cent. of ash, may be so perfectly washed as to yield only 2½ per cent.

Employment of Quick-lime in high Furnaces, instead of Limestone, by C. Montefiore-Levi, and Dr. Emil Schmidt.—From experiments made at the Iron Works of Ougrée near Liege, they found that to produce 100 kilogrms. of pig-iron, the average consumption of coke for six months of 28 days, when limestone was used, was 160½ kilogrms.; whilst with burned lime the consumption was only 146½ kilogrms., being a saving of 8·88 per cent. The average production for 28 days with limestone was 461,000 kilogrms., and with burned lime, 735,000, or an increase of 24·3 per cent. Corresponding results were obtained with another furnace, worked for three months with limestone, and three with burned lime. The average coke consumed per 100 kilogrms. with the former being 162, and with the latter 147½ kilogrms.; the production of iron per month being on an average 469,000 with limestone, and 563,000 kilogrms. with lime. The furnaces at Ougrée have now been working 3½ years with lime, with the same result, the saving per year notwithstanding the cost of burning the lime, being 30,000 francs per furnace. The same process has been successfully tried in some parts of Wales and in England.—*Zeitschr. des Ostr. Ing. Vereins*, 1852. p. 145.

Manufacture of Coke free from Sulphur—A French Manufacturer, named Barthelemy, of St. Ouen, has communicated a process which he has followed for many years, to desulphurize coke. By this process the combustion of the coal is employed for generating steam, whilst a coke free from sulphur is at the same time produced. Instead of ordinary fixed fire-bars, M. Barthelemy substitutes a moveable grate, in which the bars, which are simple straight ones, run crossways, instead of from the door towards the bridge, as in the usual common furnaces. The ends of these bars are connected by means of two endless chains, by which they can receive an onward motion. The coal falls in regulated quantities every four or five minutes on those bars, which are not yet arrived at the fire-place, and which then receive an onward motion so as to bring the fresh coal into the fire-space, where it remains at rest for four or five minutes, during which it becomes

ignited. The bars, which have now reached the position where the fresh coal is introduced, in the mean time receive a fresh quantity of coal, which is in like manner moved on and allowed to rest until it is fully ignited; by this movement the first coals, now in a state of ignition, move on also into an arched flue, where the heat is very intense. From station to station the first coal reaches the further point of the endless grate, where it passes over the guide roller, here it falls into a trough, and at the same instant a cock opens and allows a jet of steam to play on the coal and fully extinguish it; this same steam, being dilated, then passes through the bars upon which the second mass of coal, now ignited, rests, and is decomposed, its hydrogen burning and assisting the combustion, whilst part of its oxygen unites with the sulphur of the coal and converts it into sulphurous acid, which burns with a blue flame at the mouth of the furnace. By this simple process the second portion as well as all succeeding ones are completely desulphurized, so that if the first trough-full, not acted upon by the steam, be laid aside, all the coke produced in this way during the working of the steam-engine will be quite free from sulphur.—*L'Abbe Moigno's Cosmos*; also *Polytechnisches Centralblatt*, May, 1853.

Hardening of English Cast Steel for Cutlery.—August Kieser, of Issny, in Switzerland, prepares some admirably hardened razors, pen-knives, &c., from English cast steel, by immersing the blades at a dark cherry-red heat, into a bath composed of—

- 4 parts of finely-powdered yellow rosin,
- 2 parts of fish oil, to which is added, in a very hot state,
- 1 part of melted tallow,

and allowing them to cool perfectly; after which they are heated without wiping them, and hardened in water in the ordinary way. The blades hardened by this process are found to be more uniformly done than by any other method; at the same time that they are not too much so, or the metal too brittle; the edge is exceedingly fine.—*Gewerbeblatt aus Württemberg*, No. 15, 1853.

New application of the Centrifugal Machine, by H. Grüneberg.—A very ingenious application has just been made of the Centrifugal Machine, now so largely employed in drying cloth, draining sugar, cooling worts, &c., namely, to rapidly separate very finely divided precipitates suspended in water. M. Grüneberg, finding that white lead obtained by his process of precipitation, took a considerable time to settle, applied the centrifugal machine to effect his object. His modification consists of a copper drum, tinned interiorly, and having a solid periphery instead of the wire gauze ones of the usual machines. In the bottom of the drum, which has a slight inclination towards the centre, is a draw-off cock, and there are a number of partitions soldered on to the periphery, so as to divide the drum into a number of compartments, and thus prevent the circulation of the liquid during the rapid rotation of the machine. There is, of course, no external vessel, as there is no straining of the liquid through the side of the drum. In using it for white lead it was $\frac{3}{4}$ filled with milky fluid, and was then rotated at the rate of about 1,000 times per second; in ten minutes the whole of the precipitate was separated, and deposited as a thick paste on the walls of the drum, the liquid becoming perfectly clear, and may be drawn off by the cock.

There can be no doubt that such a machine could be employed with great advantage in the manufacture of colours, emery and other polishing powders; but perhaps its chief use would be in the manufacture of earthenware. The process at present followed in the English potteries to separate the excess of water in the manufacture of ground flint, china clay, &c., and obtain them in a sufficiently plastic state to work them on the potter's wheel, is exceedingly unwholesome and very expensive. If the process which we have described could be applied, the clay might be obtained in a few minutes, in nearly the condition required for moulding it, and perhaps even for throwing. It would certainly be worth a trial by some manufacturer.—*Journal für Praktische Chemie*. Bd. 60, p. 171, October, 1853.

Purification of Graphite for Lead Pencils.—Runge proposes to purify poor graphite for pencils by digesting for thirty-six hours the finely powdered mineral

with about double its weight of concentrated sulphuric acid, then diluting the acid with water, and washing the powder free from acid. Graphite thus powdered is very much cheaper than the ordinary English, and is quite as pure as the best Borrowdale black-lead. The decanted sulphuric acid contains iron, sulphate of alumina, &c.; the latter may be separated when large quantities of graphite are operated upon. Runge also proposes to add a little lamp-black with the graphite, in order that the lines made by the pencils may have a deeper shade of black. Probably certain kinds of manganese may be used for the same purpose.—*Le Technologiste*, April, 1853, p. 360.

Chemical Composition of the Enamel of Watch Dials.—Faisst gives the following as the result of his analyses of the three different mixtures used for enamelling the dial-plates of watches:

Ground for the Enamel.		Enamel Glass.	Black Powder used to Paint the Numbers, Letters, &c.
Silica	43·12	36·06	Silica 18·56
Oxide of Lead	17·21	43·82	Oxide of Lead 37·61
Oxide of Iron and traces of Alumina	2·94	2·67	Oxide of Iron 6·67
Lime	1·43	1·87	Oxide of Cobalt 37·12
Soda	10·43	5·24	
Oxide of Tin	12·11	7·64	
Arsenious Acid . . .	3·05	1·24	
	100·29	98·54	

—*Gewerbeblatt aus Württemberg*, 1853, No. 10, and *Polytechnisches Centralblatt*, No. 8, April, 1853.

The Artificial Flowers in Enamel of M. Lacombe.—M. Lacombe has lately directed his efforts to the production of artificial flowers in enamel, with the ordinary glass-blower's lamp. Some of the specimens, mounted on platinum wire, are of remarkable beauty, and exhibit a much greater variety of colours than has hitherto characterized enamel painting.—*Bulletin de la Société d'Encouragement*, April, 1853.

Sulphate of Lead as a substitute for Oxide of Tin in making Enamel.—Albert Ungerer, of Pforzheim, states that, if sulphate of lead, which, as our readers know, is a substance produced as a secondary product in many manufactures, be added to flint glass, to the extent of about 25 per cent., a beautiful enamel glass will be obtained, which, although very heavy, becomes much more fluid on being melted than the tin enamel.—*Polytechnische Journal*, Bd. 127, p. 463.

Manufacture of Artificial Blocks by igneous means, adapted for Hydraulic and Marine Constructions.—M. Bérard proposes to produce single artificial blocks 15 to 16 yards cube, which can be employed in the construction of fishing piers and other marine works, and which will be solid enough to bear transport, resist the mechanical action of the waves, and be unacted on chemically by alkaline and acid waters; and being made of very common materials, found everywhere, will be cheap enough to be employed with economy even where stone is abundant. His blocks are, in fact, great bricks heated so strongly as to become semi-vitrified, and would consequently be amongst the most durable substances known. The following is a description of the process which he adopts:—A block is first constructed of unbaked bricks, simply dried in the sun. When sufficiently dry the bricks are built up into a mass of sufficient size, some combustible material being interstratified between each layer of bricks, the whole being, in the first instance, built upon a sort of grating of common brick, so arranged as to have a sufficient number of air channels between them. A jacket of brick is built all around this pile, separated from it by a space of about one foot to fourteen inches; this vacant space is filled with small coal. The fire is put to the base and gradually spreads to the top, heating the whole interior mass of the block, the temperature of which soon reaches the point at which the clay begins to soften, previous to fusion. The contraction caused by the burning of the bricks, and the combustion of the inter-

posed coal, give rise to cavities in the interior of the mass, which, however, disappear as fast as they are formed. When the whole is in full combustion, the top is covered with a last layer of coal and several thicknesses of brick, and every orifice is stopped up and the whole mass allowed to cool slowly.

Common coal, or anthracite, or even coke dust, may be used as fuel—the quantity depending upon the nature of the clay and the quantity of sand which it may be thought necessary to mix with it; it would not, however, be much more than what would be required for the simple burning of the bricks.

In order to remove the block the jacket should be taken away and the ashes removed. The difficulty of transport alone would be the sole obstacle to the size of the block which could be made in this way. The density of such a mass is superior to that of blocks of limestone, varying according to the nature of the clay employed. Ferruginous clays would give blocks of a density of 2·4 to 2·5, corresponding to a density, after immersion in sea water, of 1·3 to 1·4; that is, superior in point of resistance by more than one-fourth to ordinary blocks. We might even construct, by damming out temporarily the water, entire dykes or jetties without any solution of continuity, and which would offer a barrier to the waves as immovable as it would be indestructible.

When the operations above described are properly performed, its solidity and its capability of resisting fracture leave nothing to be desired; as to its hardness, iron tools have no effect upon its surfaces, from which it may be concluded that the action of the waves would be perfectly inoperative.—*Comptes Rendus de l'Academie des Sciences, March, 1853.*

Manufacture of Artificial Ivory Veneers, by J. Munk, of Gaisberg.—Artificial ivory veneers, employed as a substitute for ivory and bone veneers in inlaid work, &c., are made from goat and sheep bones and fleshings of deer skins, parchment parings, &c. The bones are first treated with chloride of lime for about ten to fourteen days, then washed with water and dried. The bones thus prepared are then introduced, along with the fleshings and parchment parings, into a copper, and dissolved by means of steam until they form a fluid mass. Into this one-fourth of a pound of alum to each ten pounds of material is introduced, fire being at the same time made under the copper, in order that the alum may combine with the mass; as soon as the scum rises it is taken off, until the mass looks clear and pure. Any desired colour is now added while the mass is still warm, after which the mass is strained through linen cloth, and poured into the proper forms, in which it is allowed to remain until it is sufficiently cool to allow the contents of the mould to be turned out on cloths stretched upon frames, where they are allowed to dry in the air.

When the plates are perfectly dry, they are steeped in a cold solution of alum, from eight to ten hours, until they have acquired the required degree of hardness. For this steep a half pound of alum is employed to every pound of veneer. When the artificial ivory is taken out of the alum solution, it is washed with clean fresh water, again dried upon the frames, when it may be considered finished.—*Gewerbeblatt aus Württemberg, No. 18, 1853; also, Polytechnisches Centralblatt, No. 14, 1853.*

Gutta Percha Paper.—Peron has invented a kind of paper made from gutta percha, which is considered to be superior to all other kinds for lithographs and engravings.—*Compt. Rendus de l'Academie des Sciences, t. xxxv. p. 707.*

Etching Liquid for Lithographers.—Chevallier and Langlume propose for the purpose, 6 parts of fused chloride of calcium, dissolved in 19 parts of rain-water, and filtered. In this solution 4 parts of gum-arabic are to be dissolved, and 1 part of pure muriatic acid added to it. This solution serves at the same time to etch to gum, and by its penetrating the stone to keep it moist during the printing, a matter of great consequence.—*Gem. Wochenblatt des Gewerbevereins zu Köln, 1853. No. 1.*

Gutta Percha for Stereotyping.—If a page of type set up for printing, be heated, and then pressed upon a flat block of gutta percha, a perfect matrix is produced, from which a stereotype plate may be obtained by the ordinary galvanic process, which will give impressions fully equal to the original type.—*Polytechnisches Centralblatt, No. 3, 1853.*

Bethel's Process of Preserving Woods, by means of Pitch Oil, obtained by the distillation of the pitchy mass left after the separation of the lighter oils, called Coal Naphtha.—The experience of the London and North-Western Railway, the Stockton and Darlington, and the Lancashire and Yorkshire, have shewn that the wood used for sleepers, impregnated with this oil, is exceedingly durable, and that hence there would be considerable economy in using it on our railways. It is also found that timber so impregnated is not attacked by the terredo, or other boring animals, a fact which is of great importance in the construction of harbour piers, &c. The same oil sprinkled over land is found to be destructive to worms and larvæ of insects. It would be worth while making some experiments to test this point upon lands under green crop culture. It is singular that no one has attempted to utilize the immense quantity of gas tar annually produced in Dublin, although there is a gradually increasing demand for the product; the very residual charcoal left in the distillation of the pitch oil, being now found to be, from its complete freedom from ash, exceedingly well adapted for the manufacture of the finest steel.

New Filter for Purifying Oils.—M. Tard, of Paris, employs a peculiar substance to filter his oil. He mixes paper pulp with from $\frac{1}{4}$ to $\frac{1}{2}$ its weight of sawdust, that of beech being preferred, washes the mixture well for several days, and then moulds it into cakes. One of these 9.8 inches in diameter, and 32.6 inches in thickness, and weighing about one pound, is capable, with a pressure of 13 feet of oil, of filtering 317 gallons in 24 hours.—*Polytechnische Zeitung*, No. 1, 1853.

Manufacture of cheap Bronze colours from Brazil-wood and Log-wood, adapted for Paper-sainers, by Denzer.—If some alum be dissolved in a hot decoction of Brazil-wood, which had been previously allowed to clear itself, by resting for several days, a precipitate will form on the liquid cooling, which will gradually increase if it be set aside, and will contain nearly the whole colouring matter. If this precipitate be washed once with water and rubbed thick on paper, it will dry with a beautiful brilliant golden, tending somewhat to green, colour, which resembles the wing cases of dried spanish flies. If a little of this precipitate in the condition of a paste be mixed with size and some satining material (formed of wax dissolved in soap), and then rubbed with a brush upon paper, it may be polished with an agate or glass ball, upon which it will assume a beautiful yellow metallic lustre, very similar to bronze. To obtain this effect, however, it must be laid on sufficiently thick to be perfectly opaque.

Similarly a bronze colour may be made from log-wood, but the preparation is different, and the colour is more like that of copper, whilst the former approaches nearer to the colour of brass. If a fresh prepared decoction of log-wood be heated in a copper pan, then precipitated with chloride of tin, (tin salt,) a rich dark brown precipitate will be obtained. This precipitate, washed and treated as the last, communicates to the paper a copper bronze. A different shade may be obtained by adding to the hot decoction of log-wood a little alum, and then decomposing it with a still smaller quantity of red chromate of potash; this precipitate is darker, and its lustre on paper tends more to yellow than the latter, forming an intermediate shade between both.

These precipitates are very well adapted for the manufacture of room and other ornamental papers, being much cheaper than ordinary bronze colours; for if the mixture of size, satining stuff, and colour, be successfully made, the metallic lustre will appear by merely rubbing with a moderate stiff brush.

The following formulæ may be useful to any one wishing to try them:—1. 10lbs. of Brazil-wood are to be boiled four times with rain or good river water, so as to extract the whole of the colouring matter; and the different decoctions mixed and allowed to stand for, from four to eight days in an open wooden vat. The clear solution is now to be withdrawn from the deposit in the bottom, the vat cleared out, and the liquid again returned. 5lbs. of alum are then to be dissolved and mixed with the decoction, and the whole allowed to stand for eight days, after which the liquid is to be run off, and the preparation is to be collected on cloths, and kept in a pasty state for use.

2. 10lbs. of log-wood are to be boiled with rain or good river water filtered

through a sieve, and boiled down to half, and 10 oz. of tin-salt added; after the precipitate has subsided it is to be collected as before.

3. Or instead of the tin-salt, 10 oz. of alum are to be added to the evaporated decoction, and allowed to dissolve, and then powdered red chromate of potash sprinkled in as long as a small portion of the precipitate spread upon paper still appears of a dark blue, for which purpose about $1\frac{1}{4}$ oz. will be found sufficient. Too much red chromate makes the colour black and destroys it. This precipitate is also to be collected on a cloth and preserved damp.—*Polytechnische Zeitung*, 1853. No. 5.

Colouring Material for fixing Designs upon Muslin, by A. Faist.—10 parts of rosin are melted in a pot, and 10 parts of sulphate of lead and $1\frac{1}{2}$ of fine lamp-black are then well worked up with it. When cold the brittle mass is to be and used with gum or other mixture. White lead will answer as well as the sulphate. — *Gewerbeblatt aus Württemberg*, through *Polytechnisches Centralblatt*, No. 1, 1853.

New process of MM. Bavelier and Champonnois for the Manufacture of Spirit from Beet-root.—During the crises of the indigenous sugar manufacture in France, but especially in 1840, many attempts were made to manufacture spirit directly from beet-root, and several factories were at that period converted into distilleries. The idea was not however successful, owing partially to the low price of spirits at the time, and also, and perhaps in a greater degree, to the great expense attending the extraction of the juice, and to the irregularity of the fermentation, in consequence of the change which took place in the juice in the reservoirs. The ordinary mode of extracting the juice by rasping the roots, and then pressing the pulp, however well adapted for making sugar, where each operation is carried on on a small scale, is by no means adapted for making spirit, where very large quantities of juice are required at once; hence those who used their sugar factories as distilleries very soon relinquished the spirit trade. Another process was, to boil the sliced root until it formed a thick liquid, which was then fermented and distilled. It is unnecessary to say that this was a very clumsy process, for the fermentation never went well, and the distillation was always attended with danger from the burning of the bottom of the still, besides which, the spirit thus obtained was loaded with the peculiar nauseous oil of the beet. MM. Bavelier and Champonnois have, it appears, overcome all these difficulties, for they have invented a process which fulfils these four conditions—1. The complete extraction of the juice; 2. Regularity and completeness of fermentation; 3. The distillation of a purer juice by cheap and effective means; and 4. The utilization of the residues. Their system of operations consists in slicing the roots, and extracting the juice by the plan of maceration, which is effected in an apparatus of great simplicity, and which is cheap and easily worked. The principle of maceration consists in washing out the soluble constituents of the beet with water, or, in other words, in the substitution of the juice in the cells by water. Beet juice contains, besides the sugar, a quantity of salts, and albumen, &c. When slices of beet are consequently washed with cold water, the albumen is removed, and the whole of the soluble salts, so that nothing remains but the cellular matter of the beet, filled with nearly pure water. This residue would possess scarcely any value as food, and could indeed only be employed as manure. When beet juice is fermented the sugar is converted into alcohol, and may be obtained by distillation; and there remains behind certain of the valuable constituents of the beet, such as the salts, nothing indeed being lost but the sugar. If we could restore all these things back to the sliced roots, we would have everything, minus the sugar. Such is the principle of the new process. The sliced roots are placed in a closed macerator, and the residual wash of the still, while still at a boiling temperature, is run in upon it, and takes the place of the juice, which passes at once into a closed vat at the exact temperature at which it is to be fermented. There is a great advantage attending the use of the boiling wash—namely, that it coagulates the whole of the albumen in the cells of the beet, so that the juice which passes into the fermenting vats is nearly a solution of pure sugar. The albumen thus left in the residual beet enhances its value as food for cattle, and the wash used in macerating it, having restored the

remainder of the constituents of the beet, and certain substances added as yeast, we have, in fact, the original beet, minus the sugar, converted into alcohol. The process is therefore continuous, and leaves nothing to be desired more.

Pure sugar, when wholly converted into alcohol, would give nearly its own weight of proof spirit, or, in round numbers, one ton would give 240 gallons of spirits. The low sugars sometimes used by distillers do not yield so much, the revenue estimating, we believe, the produce per ton at about 180 gallons. Beet root usually contains on an average, when properly grown, 10 per cent. of sugar, so that one ton of beet, if the whole of the sugar was converted into alcohol, would yield about 23 gallons of proof spirits. We recollect an experiment made at Cork, in 1846, by Mr. Joseph Shea, of that city, who, with the very imperfect means at his disposal for exhausting the roots, which were the common mangel wurtzel, obtained 17 gallons of proof spirits per ton of roots. Now, supposing the residue of a ton of roots to produce, for feeding purposes, only one-third of the price of the original roots, taken at 15s. per ton, namely, 5s., we should have, as the cost of the raw material of 17 imperial gallons, assuming merely the result of Mr. Shea's experiment, 10s., or about 7d. per gallon.

A barrel of barley at 12s. is usually assumed to yield 10 gallons of spirit, and allowing the wash and grains to produce 2s 6d. we shall have 1s. as the cost of the raw material of corn whiskey. But besides this there would be an enormous difference in the expenses of manufacture. The power required to slice the beet would be small compared to the expense of milling the grain, and mashing, in addition to which we should have to add the expense of malting part of the grain, the fuel for heating, the coppers for mashing, &c. The plant for a beet-root spirit distillery would perhaps not be more than one-sixth that of an ordinary corn spirit one. We believe this new industry is well worthy the attention of the distilling trade in Ireland. It may not supersede the ordinary corn whiskey for Irish consumption, as raw beet whiskey could not be drunk, but a great trade might be established with England, as the whole of the spirit consumed there is first rectified.—*Annales de l'Agriculture Française*—September, 1853.

Process by which the juice obtained by re-pressing Beet-pulp in the manufacture of Beet-sugar may be profitably worked, by A. Cornill Woestyn.—In the manufacture of beet-sugar the rasped pulp gives, under the most favourable circumstances, but 80 per cent. out of the 93 to 95 of juice, which the beet contains. It has frequently been proposed, and has even been largely practised, to re-moisten the pulp with water, and subject it to a second pressure, by which the greater part of the remaining juice may be obtained. No great advantage has been derived from this operation; 1st, in consequence of the very weak juice which was obtained, and which, therefore, required a very large quantity of fuel to boil it down; and 2ndly, because the juice of this second pressure was always more or less altered, and usually injured that resulting from the first pressure, with which it was always mixed, and thus diminished both the quality and the quantity of sugar produced. M. C. Woestyn, by a series of experiments, which he carried on on a very large scale in the factory of Count Alexis Bobrinski, at Michailoski, in the Russian government of Tula, has found a means of obviating all the disadvantages attending the re-pressing of the roots. He works the juice of the first pressing by itself, and then re-presses the pulp, and for this purpose uses a different set of presses, &c. By the second operation a juice is obtained of about one-half the density of the juice of the first pressing, say 3° to 4° of Beaumé, which he raises to 12° by mixing with it a quantity of the molasses of the third crystallization. The after operations are the same as with the first juice. In the factory of Michailoski, 80 per cent. of juice, averaging from 7° to 8° is obtained in the first pressing, and 10 per cent. at 4° by the second. In the whole season of 1852–1853, 9,600,000 kilogrammes, or about 9,449 tons of beet were worked up: by the second pressing the pulp of this quantity yielded 19,200 hectolitres, or 507,240 gallons of juice, marking 4° of Beaumé, which treated as just described, yielded 190,400 kilogrammes, or 187 tons, 8 cwt. and 22lb., or 2 per cent. of fine yellow sugar. About $\frac{1}{4}$ per cent. of this quantity was derived from the molasses, that being about the quantity of very inferior sugar, which is usually obtained by allowing the molasses of the third crystallization to rest for three or four months in the crystallizing vessels, so that the clear gain of the new process

was fully $1\frac{1}{2}$ per cent. of superior quality sugar. The additional apparatus which would be required in a factory working 9,000 to 10,000 tons of roots would be three hydraulic presses, a juice reservoir, a blowing-up pan, and a scum press. The vacuum apparatus should also be capable of making three additional boilings in twelve hours. This process, if properly carried out, would have great influence on the success of a beet sugar factory, and is therefore worthy of the attention of those intending to erect such establishments.—*Moniteur Industriel*.

New Yellow Variety of the Sugar Beet.—M. Perier, manufacturer of sugar at Flavy-le-Myrtel, sent to the Central Society of Agriculture of France, a small bag of the seed of a new yellow pear-shaped variety of the beet, with very slightly coloured flesh, and containing apparently more sugar, on an average of a great number, than any of the varieties hitherto known. The following is the result of Payen's analysis :—

Water	82.35
Pure sugar	11.45
Other organic substances	5.55
Alkaline salts	0.45
Earthy salts	0.20

Purification and Application of Glycerine, by M. Bruère Perrin of Rennes.—Solid fats and oils are composed of two principles, fatty acids and a sweet oily substance, termed glycerine or fat-sugar. The process of making soap consists in boiling a fat with a ley of potash or soda, which unites with the fat acids and sets the glycerine free. In the manufacture of stearic acid for making stearine candles, by saponification with lime, a considerable quantity of glycerine is also produced. Until lately this substance formed the waste ley of the soap boiler, and was rejected as useless, or when purified was merely employed in the researches of the chemist. Its first practical employment was in certain diseases of the ear; subsequently it was found to be very efficacious in the cure of cutaneous diseases, for which it is now largely employed. M. Bruère Perrin has made several new applications of it, which are important; for example, he uses it for toilette soaps, to which it gives the property of softening the skin, and of healing it when cracked from exposure to cold or other causes. The soap thus made preserves its first consistence, and at the same time that it is quite unctuous does not grease the hands. He also prepares a cosmetic vinegar, which has been pronounced excellent. We may also state here that M. Barreswil has used it with success for preserving clay in a sufficiently plastic state to model with, and M. Chevallier, has proposed to mix it with the size used in preparing the warp of linen and cotton, in order to keep them damp and prevent the shuttle wearing the fibres. There can be no doubt that this idea is worth a trial, for glycerine could be much more easily removed, and would therefore oppose less obstacle to the proper bleaching and printing of the cloth subsequently, than chloride of calcium, which is often used at present.

M. Bruère Perrin purifies the glycerine obtained by saponification with lime in the following manner. Having first determined the quantity of lime existing in the glycerine by means of oxalic acid in the usual manner, he adds sufficient sulphuric acid to convert the whole of the lime into sulphate of lime. He then concentrates it in a tinned copper pan; agitating it briskly during the operation, by means of an agitator armed with battledore-shaped plates, and set in motion with a winch; during the concentration there is a disengagement of vapours of a very disagreeable odour, and a partial decoloration of the liquid. When the liquid has acquired a density of 10° of B. (1.070) it is allowed to cool, and strained through cloth to separate the sulphate of lime; any excess of acid which may have been added is then saturated with carbonate of potash, and the liquid again concentrated with constant agitation. As soon as the liquid marks 24° (1.187) it deposits a quantity of sulphate of potash under the form of gelatinous mass; it is then allowed to cool, strained through linen, and the deposit washed with a little water, to which a very little alcohol has been added. It is again evaporated for the third time, until it attains a density of 28° hot (1.2258) or 30° (1.2459) when cold, and allowed to cool, by which a small quantity of sulphate of potash again separates, which is removed by filtration. The substance resulting from these operations is of amber

colour, and without any marked odour; it has a sweetish taste and is unctuous to the feel. It is now treated in the cold with animal charcoal, and filtered, by which the glycerine is obtained in the form of an odourless and colourless syrup. Glycerine mixes with aqueous liquids, alcohol vinegar; it lubricates bodies without greasing them like oil; it does not evaporate in contact with air, and may be readily impregnated with the aroma of the volatile oils, and finally it is not susceptible of fermenting or of becoming rancid.—*Bulletin de la Societe de l'Encouragement*, May, 1853.

Method to prevent the decomposition of Urine, and to preserve it for the use of Farmers, at Railway Stations.—Chevallier proposes to preserve the urine at railway stations, for agricultural purposes, in large cisterns, and to preserve it from decomposition by adding some (5 or 6 drops to each pound of urine) coal-tar or coal-tar oil, which acts in this way most effectually. (When we recollect that the urine of 400 persons in a year is capable of manuring about 10 acres of land, some means ought certainly be devised to preserve so valuable a matter. The employment of a little sulphate of iron or caustic lime in the water closets, would certainly be more effective in checking the effluvia than the present system of throwing a jet of water over the trough, the apparatus for effecting which is rarely ever in order.—*Journal de Chimie Medicale*, August, 1852.

ART. IV.—*Bulletin of Industrial Statistics.*

[Under this head it is intended to give in the course of the year an epitome of the most recent industrial statistics of all the chief States of Europe, the British Colonies, and such of the American States as we can obtain any information about. It is also intended to indicate all material changes in the Tariffs of the chief commercial nations, and everything of importance connected with Commercial Legislation generally, which shall come under the knowledge of the Conductors.]

PROGRESS OF FLAX CULTIVATION IN IRELAND.

The recent increase in the growth of flax in Ireland has been extraordinary, as the following table, containing the number of acres under cultivation in each of the six last years, will show:—

1848	...	53,863 acres.	1851	...	138,619 acres.
1849	...	60,314 "	1852	...	137,008 "
1850	...	91,040 "	1853	...	175,495 "

There has thus been an increase of 29 per cent. last year over the crop of 1852; and 220 per cent. over that of 1848. The increase in the three provinces of Leinster, Munster, and Connaught, of the crop of 1853 over that of 1852, has been 22 per cent.; and over that of 1848 no less than 436 per cent.—the number of acres under cultivation in these provinces in 1848 being 2,663, and in 1853, 14,279. Notwithstanding this enormous increase in the production of home-grown flax, so rapid has been the development of the linen manufacture of these countries, that the imports of flax and tow amounted in 1852 to 70,115 tons, or the produce of about 280,000 acres. And during the nine months, ending the 5th of October, 1853, the imports reached 62,264 tons, being an increase of 13,677 tons over the corresponding period of 1852.

Flax is becoming an article of export from Ireland, and the trade will, no doubt, rapidly increase if the cultivation of flax still further increase, as Irish flax seems to be sought after for certain purposes, not alone in England, but on the Continent. Of the crop of 1852, there was exported 6,696 tons of flax, and 2,308 tons

of tow—total, 9,004 tons; value, £392,500. Of this quantity 413 tons were exported to France. The export in 1850 was only 3,166 tons.

In 1852, there were 956 scutch mills, with 5,053 stocks in operation, fifty being worked by steam. These mills employed about 15,000 persons, whose aggregate wages may be estimated at £160,000. Forty of these mills, with 340 scutching stocks, were in the province of Leinster, Munster, and Connaught. During the year 1853, the number of mills has considerably increased, but no return has yet been made.

The Irish farmers are beginning to learn the value of saving the seed, as is shown by the fact, that 20,000 bushels of seed were sold during the past year in Belfast alone to the oil mills, or for exportation to England, the sum realised being £5,000. Three new oil mills, on Continental principles, have been erected in Ireland in 1853, two of them being in the south of Ireland.

[See Report of the Flax Improvement Society of Ireland for 1853.]

PROGRESS OF THE COTTON MANUFACTURE IN RUSSIA.

The cotton manufacture is rapidly increasing in Russia. It is scarcely more than twenty years since the first spinning mill was erected, and now it has 350,000 spindles in full activity, which produce more than 300,000 pounds of yarn (10,800,000lbs.)* The yarn spun is generally very low, the Nos. usually varying from 20 to 40 for the woof, because there is a large market for coarse fabrics. The principal seat of the manufacture of the coarse goods is central Russia, especially in the Governments of Moscow, Wladimir, Kalouga, Kostroma, &c. The peasants receive the yarn from contractors, and occupy themselves in weaving during the winter at very trifling wages. The goods thus manufactured in the villages may be divided into three classes, according to the quality of the yarn. The first includes those of the lowest quality, and which are sold at 18 to 24 copecks the arsheen (about 2½d. to 3½d. the yard). The warps are formed of No. 28 yarn, and the woof of No. 30. The fabrics of a medium quality, valued at 25 to 28 copecks the arsheen (about 3½d. to 4d. the yard), are formed of Nos. 34 and 36 warp, and 38 to 40 woof. The better class of fabrics are made of foreign yarn, Nos. 38 to 42 for the warp, and 44 to 48 for the woof, and sell at 29 to 32 copecks the arsheen (about 4½d. to 4¾d. the yard.)

Besides the factories producing the classes of goods just mentioned, there are 140 others for the superior articles, without including cotton velvets and muslins. The former branch of manufacture has been greatly developed within the last few years, the chief market being China. Before the establishment of the Russian factories the Chinese markets were exclusively furnished by Great Britain with cotton velvet; but at present that article, with cloth, forms the chief export to China; even so early as 1842, the quantity exported to China amounted to three millions of arsheens, or about 2,333,000 yards.

The manufacture of printed cottons is said to have arrived at nearly the same degree of perfection within the last twenty years as in Manchester or Alsace. The chief seat of this branch is at St. Petersburg, where it is chiefly carried on by the Swiss. The quantity made is estimated at about three millions of pieces, which is sufficient to supply the whole empire. At present not more than 1,500 pieces of the finest prints are imported for the use of the higher classes. The manufacture of muslins is also progressing. We may also add here, that several successful attempts have been made to introduce the cultivation of the cotton plant into the Caucassian provinces, and that the quantity grown increases from year to year.

The total value of the cotton fabrics produced in Russia may be estimated at more than 40,000,000 of silver roubles, or about £6,400,000 sterling.

The following table exhibits the imports of raw cotton and yarn into Russia, from 1846 to 1850:—

* Since 1850 the increase has been still more remarkable, if our authority is to be relied upon; for there are now 50 factories, with 600,000 spindles, employing 10,000 persons, and producing 700,000 pounds of yarn, or 25,464,500lbs.—From *Deutsche Gewerbezeitung*, Heft 2, 1853.

Years.	Raw Cotton.	Cotton Yarns.	
		White.	Dyed.
1846	26,152,450 lbs.	18,288,000 lbs.	114,750 lbs.
1847	31,127,040 "	15,147,000 "	128,250 "
1848	44,471,962 "	14,231,250 "	126,000 "
1849	56,154,372 "	10,287,000 "	150,750 "
1850	44,257,500 "	6,221,250 "	112,500 "

We thus see that the importation of raw cotton has nearly doubled, while the import of cotton yarn has diminished by two-thirds. In 1832, Great Britain exported 19,587,781 lbs. of cotton yarns and fabrics, value £1,136,787; whilst in 1850, the total quantity of yarn imported from all parts of Europe was 5,602,248 lbs., or little more than one-fourth. [See *Annales du Commerce Extérieur*—Official Journal of the Minister of the Interior of France, No. 679, March 1853.]

CONDITION OF MANUFACTURING INDUSTRY IN SWEDEN IN 1851.

There appears to have been a stagnation in the trade of Sweden in 1851, as the total value of the manufactures was only 24,305,603 rix dollars *banco* (£2,025,466), not including the products of the machine factory of Motala, which was estimated at 479,061 (£39,921 15s.) This sum shows an increase upon that of 1850 of only 17,609 (£1,467 8s. 4d.) The number of factories has increased by 24, 2,537 being in operation, but the operatives had diminished by 179, the total number being 23,248.

The total value of the products of the 156 cloth factories, protected by an *absolute prohibition*, was only 5,644,427 rix dollars (£470,369), being 1,273,430 (£106,119) less than in 1850. The consumption of woollen cloth is continually augmenting, without any sensible diminution of price; so that the decrease just mentioned, which is entirely confined to the finer articles, can only be attributed to the precarious state of the trade.

The 17 silk factories, similarly protected, have also suffered a diminution in production to the extent of 58,436 rix dollars (£4,869 13s. 4d.), the total value being 909,667 rix dollars (£75,805 11s. 8d.) On the other hand, the production of cotton yarn was 6,005,081 pounds, or 5,629,763 lbs. British, value 3,279,493 rix dollars (£273,291); that is, 270,749 pounds, or 253,828 lbs. British, value 79,593 rix dollars (£6,632 15s.) more than in 1850. There was also an increase in the production of cotton and linen fabrics to the extent of 67,862 rix dollars (£5,655 3s. 4d.)

Glass increased to the extent of 49,551 (£4,129 5s.); paper, 158,203 (£13,183 11s. 8d.); oil, 127,267 (£10,605 11s. 8d.); refined sugar, 79,230 (£6,602 10s.); tobacco and snuff, 197,478 (£16,456 10s.); and leather, 246,949 (£20,579).—[*Idem*, No. 737, October, 1853.]

COMMERCE OF SWEDEN IN 1851.

The total value of the imports and exports of Sweden, not including the precious metals, for the year 1851, was 54,458,000 dollars *banco*, or £4,529,500; being an excess over that of 1850 by 6,428,000 rix dollars, or £527,000. Of this sum the importations formed 27,500,000 rix dollars, or £2,291,666; and the exportations, 26,854,000 rix dollars, or £2,237,833. The external commerce of Sweden in the year 1851 was therefore very favourable; in importations it exceeded all previous years; and in the value of the exports, all except the year 1847, when, owing to the very large quantity of corn exported, the value of the exports rose to the sum of 29,588,000 rix dollars, or £2,465,666. If we compare the imports of Sweden in 1851, with those of twenty years previously, it will be found that the merchandize now purchased in other countries is more than double the value of that imported in the years 1831, 1832, and 1833.

Among the imported articles, the consumption of which has especially increased, may be mentioned—raw sugar, of which 2,590,871 pounds Swedish* were imported

* 100 pounds Swedish equal about 93½ lbs. avoirdupois.

in 1851, against 10,202,443 lbs. in 1831—a fact which is the more remarkable, as the exportation of refined sugar has declined from 1,412,761 lbs. in 1846, to 145,784 lbs. in 1851; coffee, of which 9,613,934 lbs. were introduced in 1851, against 3,268,681 lbs. in 1831; cotton, the import of which was 7,989,428 lbs. in 1851, against 794,434 lbs. in 1831. There has also been, unfortunately, an increase in the consumption of spirits; the quantities being, in 1851, 54,583 kannas, or 37,662 gallons, against 46,755 kannas, or 32,261 gallons, in 1850. The other articles, the consumption of which has increased, are: machinery, salt, coal, tea, wool, and wine, (with the exception of those of Champagne, Madeira, and Malaga). The quantity of corn which cleared inwards, in 1851, was 354,819 tuns, or 174,443½ quarters; and outwards, 224,263 tuns, or 110,256½ quarters.

The increase in exportation has principally affected timber; there were exported in 1851, 815,533 dozens of deals, against 238,240 in 1831. The exportation of bar iron was 580,541 skeppunds, or 77,710 tons, 4 cwt. 1 qr., being a slight decrease upon that of 1850, in which year the export was 615,627 skeppunds, or 62,416 tons. The increase in the timber export is principally attributed to the change in the commercial system of Great Britain.

The value of the total exports to, and imports from, Great Britain, in 1851, was 14,453,000 rix dollars, or £1,204,416, or more than one-fourth of the whole external commerce of Sweden.

The navigation naturally increased with the external commerce, and was consequently more than in 1850. There arrived 6,882 vessels, having a tonnage of 318,337 lasts, or 725,922 tons; and there sailed 6,727 vessels, of 325,937 lasts tonnage, or 743,252 tons. The *Norwegian* and foreign vessels had a larger share in this increase than the Swedes.—[*Ibid.*]

CONDITION OF MINING AND METALLURGIC INDUSTRY IN SWEDEN IN 1850.

Iron Ore raised.—There were extracted, in 1850, in the whole kingdom, 1,440,114 skeppunds, or 192,771 tons 3½ cwt. of iron ore, of which the celebrated mines of Dannemora furnished 106,599 skeppunds, or 14,269 tons 3 cwt. Compared with the preceding years we have the following results:—

	Skeppunds.	Tons.
In 1849	1,502,537	201,127
1844 to 1848, mean .	1,352,123	180,902 17 cwt.
1839 to 1843, " .	1,356,547	181,586
1834 to 1838, " .	1,199,281	160,533 13 cwt. 3 qrs.

The number of workmen employed in the works of the iron mines was 5,241.

Smelting of Iron Ore.—There were in activity 224 blast furnaces, which produced 727,597 skeppunds, or 97,394 tons 17 cwt. of pig iron. The preceding year there were 198 furnaces in blast which produced 607,223 skeppunds, or 81,281 tons 16 cwt.

Castings in Iron.—The blast furnaces and the cannon foundries of Finspang, Aker, and Stafsjo, produced 23,254 skeppunds, or 3,112 tons 15 cwt.; and the other foundries, 28,045 skeppunds, or 3,754 tons 1 cwt. of castings, value 513,444 rix dollars, or £42,787. The export of shells, shot, and cannon, principally to Norway, Holland, and Denmark, amounted to 2,879 skeppunds, or 385 tons 7½ cwt.

The number of workmen employed in these foundries and blast furnaces was 3,096.

Manufacture of Bar Iron.—5,311 forges were in operation, and produced 645,934 skeppunds of bars, or 86,463 tons, 8 cwt., the number of workmen employed being 3,983. The total exportation amounted to 615,627 skeppunds, or 62,416 tons, which was thus distributed:—

Great Britain, . . .	218,851 skeppunds, or 29,295 tons.
United States, . . .	127,473 " or 17,061 " 7 cwt.
Denmark, . . .	52,295 " or 7,000 " 2 "
France, . . .	33,464 " or 4,479 " 8 " 3 qrs.
Algiers . . .	4,835½ " or 647 " 5½ "

These numbers show an improvement on the preceding years, as the following

table of the relative production and exportation of iron from 1834 to 1849 will show :—

Year.	Produced.		Exported.	
	Skeppunds.	Tons.	Skeppunds.	Tons.
1849	638,827	85,512	595,973	79,776
1844 to 1848	603,428	80,773	591,125	79,127
1839 to 1843	575,251	77,002	572,831	76,678
1834 to 1838	495,448	66,310	509,652	68,221

Manufactured Iron.—The production of manufactured articles in iron in 1850 was 86,167 skeppunds, or 11,534 tons, 3 cwt.; the quantity in 1849 being only 80,965 skeppunds, or

Production of other Metals.—Gold.—The silver mine of Gustavus III. in the mining district of Stora-Kopparberg, yielded 1 marc, 15 lods, 4 grains of gold.

Silver and Lead.—Four mines produced 6,002 marcs, 1 grain of silver, of which 2,735 marcs, 11 lods were derived from the mine of Sada. This is the highest production of the last period of five years. The number of persons employed in 1850 in the working of silver and lead was 701; the quantity of lead produced being 1,254 skeppunds, 13 lispunds, and 12 skalpunds, or 3,360 cwt. 2 qrs. and 19 lbs.

Copper, Nickel, Zinc, and Brass.—The total quantity of copper produced was 10,102 skeppunds, or 27,135 cwt., being a greater production than either of the four preceding years. 2,261 skeppunds, 13 lispunds, 1 skalpund, or about 6,058 cwt. of copper were forged. **Nickel.**—The quantity of nickel ore raised was 2,372½ skeppunds, or 6,354 cwt. 3 qrs. 18 lbs.; and the total number of persons employed in the working of copper and nickel was 2,198. **Zinc.**—The mines of zinc yielded 258 skeppunds, or 691 cwt. of metal; and the total quantity of brass produced was 581 skeppunds, 17 lispunds, 2 skalpunds, or 1,558½ cwt.

Cobalt.—There was manufactured 5,663 skalpunds of the oxide, or 4,248 lbs.; 872 skeppunds, 19 lispunds, 10 skalpunds, or 3,117½ cwt. of sulphur; 2,163 skeppunds, or 5,807 cwt. of copperas and blue vitriol; 9,253 tuns, or 36,419 bushels, of alum; 10,847 tuns, or 42,693 bushels, of red ochre; 150 skeppunds of manganese, or 401½ cwt.; and 141 skeppunds, 14 lispunds, or 379½ cwt. of litharge. The works in porphyry of Elfvedahl were estimated at 2,000 rix dollars, or £166 13s. 4d.; and the works in marble from the quarry of Kolmarden, 3,089 rix dollars, or £257 8s. 4d. And finally, the coal mines of Hoganas yielded 169,459 tuns, or about 145,779 chaldrons.

The exportation of metals from Sweden in 1850 was thus distributed :—

Copper,	7,245 skeppunds	19,406 cwt.
Nickel,	13,625 skalpunds	10,218½ lbs.
Brass, unwrought	1,874 skeppunds	5,019 cwt.
Do. wrought	1,444 skalpunds	1,083 lbs.
Wire, { Copper and Brass, 3,813 „	2,860 „	
{ Iron and Steel, 19,326 „	129 cwt. 1 qr. 19 lbs.	
Lead, unwrought	59½ skeppunds	160 cwt.
Old Iron	457 „	1,224 „
Cobalt ore	1,007 skalpunds	755½ lbs.
Prepared Cobalt	139 „	104½ „
Vitriol, { Blue	26½ lispunds	397½ „
{ Green	2,567 „	343½ cwt.
Alum	164,392 „	22,016½ „
Sulphur	3,241 „	434 „
Red Ochre	3,419 tuns	13,457 bushels.
Manganese	180 skeppunds	482 cwt. 16 lbs.
Litharge	3,896 lispunds	521 „ 1 qr. 20 lbs.

The total number of persons employed in the mining and working of metals, &c. was, in 1850, 17,982. On the whole the metallurgic industry of Sweden was in a very prosperous condition in 1850.—*Idem*, No. 672, February, 1853.

THE

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ART. I.—*The Patented Systems of Steeping the Flax Plant.* By JAMES MACADAM, JUN., *Secretary to the Royal Society for the Promotion and Improvement of the Growth of Flax in Ireland, Corresponding Member of the Société Centrale d'Agriculture, of Paris, and of the Academia Reale d'Agricoltura, of Turin, &c.*

THE cultivation of the flax plant, as furnishing the raw material of the linen manufacture, is very extensively carried on throughout Europe, and in some parts of the continents of Asia and America. In examining the flax stem, at maturity, it is found to consist of a woody interior, more or less hollow, surrounded by the fibres, as the wood of a tree is by the bark, and these fibres are naturally cemented together with a substance generally termed gum-gluten or gum-resin. In order to obtain a fibre for manufacture, freed from this matter, the practice of flax-growers has been to place the plant, either when freshly pulled, or after drying, in water, where fermentation takes place; the gum becomes resolved into its ultimate constituents, and these are dissolved or suspended in the water, which being evaporated, the residuum, on analysis, (Hodge's,) has been found to contain the following matters:—

Potash	...	...	...	...	...	27.17 per cent.
Soda	...	...	...	...	...	8.18 "
Chloride of sodium	...	...	...	...	...	21.58 "
Lime	...	...	...	...	...	5.91 "
Magnesia	...	...	...	...	...	4.60 "
Oxide of iron	...	...	...	...	...	0.83 "
Sulphuric acid	...	...	...	...	...	15.64 "
Phosphoric acid	...	...	...	...	...	5.66 "
Carbonic acid	...	...	...	...	...	12.43 "
Silica	...	...	...	...	...	3.00 "
						100.00

Throughout all the countries producing flax fibre for the linen manufacture, three systems of retting are carried out. In one case, which prevails over most of Russia, Germany, and parts of Belgium and France,

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the stems are dried, when pulled, the seed is taken off, and the stems immersed in pools, lakes, or rivers, either in the same season or in the following one. In another, which is termed dew-retting, and practised in parts of Belgium, Germany, and Russia, the dried stems, after the seed is beaten off, are spread on the field, where the action of dew, rain, or snow, effects, in a lengthened period, that decomposition of the gum, which is elsewhere more quickly obtained by immersion in water. This method, termed "dew-retting," has lately been abandoned in many districts, as it is obviously less certain in its effects than the plain steep. The third plan is that almost universally practised in Ireland, and is also carried out to some extent in the Pays de Waes, in Flanders. In this case the stems when pulled, either with or without the separation of the seed-pods, are at once put into pools or rivers. The Irish practice is very wasteful, as the seed is rarely saved.

It is obvious that, in the preceding modes of steeping flax, great irregularity must arise from variations in the temperature of the air and water, and the comparative skill of the grower in ascertaining exactly when the plant is sufficiently steeped to insure the decomposition of the gum, without the process being carried so far as to injure the strength of the fibre. Hence greater inequality of the fibre appears attributable to this cause than to the skill exerted in the details of culture. The quality of the water in which the plant is steeped also exercises a very marked effect on the colour and mellowness of the fibre. In Ireland, some pools give a fine white colour, while others impart a greyish tinge. In Holland, the ditches invariably turn out a dark grey, or, as it is termed, *blue twit*; while in Flanders, a silver-grey (*gris argenté*) is the result. The river Lys, which yields the finest fibre in the world, throughout its course is found to give a yellowish-white to the flax immersed in it. Much of the variety of tinge imparted to the fibre steeped in different places is attributable, no doubt, to the comparative purity of the water from mineral or vegetable matters; but the superiority of the Lys, and the peculiarities attending the steep of other waters, are as yet unexplained, although analyses have been made with the object. Generally, it may be stated, that the water most suitable for steeping flax is that derived from the natural drainage of the soil, such as rivers, brooks, and ditches; and that spring water is mostly unsuitable, as containing, in much greater proportion, soluble salts. Where carbonate of lime is detected in such springs, the fermentation is with difficulty effected, and the fibre acquires a harshness which renders it incapable of producing good yarn; and where iron is present to any considerable extent, its action on the tannic acid, which is readily traceable in the stem, strikes a brown or grey colour, difficult to eradicate in the bleaching of the fabric.

In consequence of the uncertainty and disadvantages attendant upon the modes of steeping ordinarily practised, much attention has been directed, at different periods, to some systematic means of accomplishing the destruction of the gum. In 1775, Lady Moira employed a solution of kelp (impure carbonate of soda and potash) to discharge this substance, and operated upon fibre previously mechanically separated from the wood

of the stem. This system, with some modifications, has since been brought prominently before the public by M. Claussen, who aimed both at the preparation of a fibre to suit the linen in manufacture, and the conversion of it into a material capable of replacing or being mixed with cotton or wool. For the first-named purpose, it appears that the process employed, though successful in getting rid of the gum, presented disadvantages, in altering the character and strength of the fibre; as a substitute for, or auxiliary to cotton, experience has pointed out insuperable defects, chiefly arising from the totally distinct character of the filaments; and as applicable to the woollen manufacture, although partially successful, its suitability is very limited. In Germany, at different periods from 1777 to 1816, attempts based on the same principle were all unsuccessful, and to this list of failures may be added that of Mr. Lee of Manchester, who, in 1814, succeeded in inducing the Irish Linen Board to take up his system, which was almost identical with the foregoing, and to expend a large sum of money in introducing it in Ireland. Like all preceding and subsequent attempts, this also fell to the ground. It appears, indeed, to be recognised, as far as we can at present judge, that, in order to obtain a fibre possessing the strength and mellowness required for its conversion into linen fabrics, fermentation, however effected, is the only safe means. Diluted sulphuric acid, soap, caustic lime, and other substances, have been repeatedly tried, here and on the Continent, but in all cases unsuccessfully.

Returning, then, to the employment of water as the means of inducing fermentation, we may proceed to examine the various modes brought forward with a view to accelerate its action.

First in order of time, and probably as yet in success, is the maintenance of the water at an artificial temperature greater than that generally afforded in any flax-growing country during the heat of summer. In 1804, at Amiens, some trials were made of subjecting flax straw to the action of steam, afterwards condensed, but no practical results followed. There is reason to believe that many private experiments, both with steam and with hot water, were made, at different periods, in the British Islands and on the Continent; but the subject was first brought prominently forward in 1847, when the late Mr. Schenck, of New York, came over to Ireland, and laid his plans before the Royal Flax Society. His system had been already tried, with success, in retting hemp, in the United States, and he argued therefrom that it would be equally suitable to flax. His views were carefully considered, and every facility given him for carrying them out, so as to exhibit the advantages, if any, attaching to his system. It may be briefly described as follows:—The dried flax straw, after the seed has been separated, is placed in wooden vats, having a false perforated bottom, under which are pipes, into which steam is introduced. The vats are filled with water, and the steam gradually heats the water, until the latter attains a temperature of 90° Fahrenheit. In 60 hours the process is completed, and the flax-straw removed. It is then dried artificially, by means of stoves, or is spread on the field, as in the usual country method, and the fibre subsequently separated from the wood by the process of

scutching. Schenck's method has been put in operation in 12 or 13 establishments in Ireland, 3 in Scotland, 10 in England, 1 in France, and 4 in Prussia and Austria. The fibre so prepared has been of very variable quality, according to the pains taken in saving and drying the plant, and the comparative skill of the conductors of the steeping process. Several concerns have been abandoned, but others have been highly successful. The faults at first attributed by spinners to fibre steeped on Schenck's system, were dirtiness, weakness, and harshness. The former arose from the small quantity of water employed, the fibres, when artificially dried, being loaded with the products of the decomposed gum, which gave them a disagreeable smell, caused a cloud of dust in the hackling, and a fouling of the hot water through which they pass in the spinning process. The last fault arose probably from the direct action of these matters on the fibre, imparting to it a dryness and roughness of feel, and depriving it of that softness and mellowness which are technically termed "spinning quality." Both these faults have been lately got rid of by means of a simple invention, which is claimed by several parties, and the advantages of which are now so fully recognised that all proprietors of reteries on Schenck's system have adopted it. This invention consists in passing the wet flax-straw, as it is taken out of the vat, between one or more pairs of heavy metal rollers, which squeeze out the foul steep water, and clean the fibre of all foreign substances, excepting, of course, the wood, which is removed by scutching. The effect of the rollers is increased by directing a stream of water on the straw, either before or after it passes through, and thus thoroughly washing away the matters referred to. Since this plan has been adopted, there have been no further complaints from spinners as to the dirtiness or harshness of the fibre. But as yet it appears that, while the fibre is fine, soft, and mellow, it is weaker than that of flax steeped in pools, in the ordinary country method. This restricts its use to weft yarns; but as these constitute the larger proportion of Irish spinning, the fault is not of much gravity.

Hot water steeping, though originating in a great degree with Schenck, has been modified in various ways by Pownall, Buchanan, Wilson, Burton, and others. It is not necessary to go into the details of all, but a few notes may be useful as regards the plan of Buchanan. In lieu of the immoveable vats of Schenck, he employs a series of iron chambers, so arranged that a current of hot water shall pass through them, and by means of pulleys the supply of water is regulated by the ascent or descent of these chambers as they become filled or emptied. The water is, at one period, at 212°, and the process is completed in twelve hours. Little, however, is known of the quality of fibre so prepared, and it is to be feared that the high temperature, instead of assisting fermentation, merely effects maceration, and that it coagulates the gum and renders it to some extent undecomposable.

At Lille, M. Terwangne has, for some time past, been bringing before the public a method of steeping, which, like Schenck's, is based on the use of hot water, but presents many peculiarities. Instead of wooden vats, he employs receptacles of brick, with a false bottom of wood. These are

filled with the flax-straw. Cold water is let in, and is heated by means of a pierced pipe underneath the bottom, which conveys steam. The temperature is 20° to 25° centigrade, (68° to 77° Fahrenheit,) and the process requires 70 to 90 hours, according to the nature of the straw. In the water is placed some chalk and wood charcoal, which are stated to prevent altogether the disagreeable smell which arises, in all steeping, from the decomposition of the gum; and M. Terwangne proposes afterwards to employ this water as manure, in combination with the ashes of the *shoves*, or woody part of the flax stem, and the cheap refuse of the oil-mills. After the water is drawn off from the brick tank, a supply of pure water is let in, to wash the flax, and the latter is then taken out, dried, and scutched. There is no definite report from French spinners as yet on the quality of fibre prepared by M. Terwangne.

While these various modes of hot-water steeping have so materially shortened the time, as compared with the usual cold water steep, other systems have been brought forward proposing still more to lessen it. These consist in the use of steam as a direct agent, and the two principal are those of M. Delisse and of Watt.

Of the former little is known, except that one hour is stated to be sufficient to subject the straw to the action of steam before the fibre can be separated.

The latter has been prominently before the public for more than a year, and demands a special explanation. The straw is placed in iron chambers, closed, with the exception of two doors for putting it in and taking it out. The top is in the form of a shallow tank, to fill the office of a condenser. The bottom is a false one, perforated. When the flax has been placed in the chamber, and the doors closed, steam is driven in by a pipe, round the chamber and beneath the bottom, and penetrates the entire mass, becoming condensed when it meets the top, and then descending in a constant drip of water upon the straw. The liquid, saturated with the decoction of the flax stems, is drawn off and employed for feeding pigs, along with dry food, but with what actual advantage there are as yet no data for ascertaining. In ten to twelve hours the chambers are opened and the straw removed, and the latter is then washed and wet-rolled, as already described in the case of the hot-water steep. Latterly Mr. Watt has half filled the chamber with water before admitting the steam, so that his original plan is considerably modified. It is now pretty well ascertained that the flax fibre so treated is not so well suited for spinning and manufacturing as that which has been steeped in cold or hot water. In fact, there is every reason to believe that the gum is but very partially got rid of by the maceration, and that fermentation is absolutely requisite in order to obtain a pure fibre. Watt's process is now in operation in ten Irish and Scotch establishments.

In summing up these observations, it may be stated that, for so far, none of these patented systems of retting flax has produced fibre equal in all respects, for manufacturing purposes, to that steeped in cold water. But great improvements have been, from time to time, carried out, and many faults got rid of. So much attention has been recently devoted to

the subject, both by scientific and by practical men, here and on the Continent, that we may look sanguinely forward to the perfecting of the principle, through which flax-growers can dispose of their crop in the straw, and system and regularity replace the present uncertain and careless practices of the farmers, and that valuable portion of the crop.—its seed,—be economised, and not scandalously left to rot in the pools, as is now almost universally the case in Ireland.

ART. II.—INDUSTRIAL EDUCATION. No. I. *Schools for Teaching the higher Branches of Science.*

THE idea which originated some months ago of paying a national tribute to Mr. Dargan, by the establishment of an institution for the special industrial education of the youth of the country, has been relinquished, wisely, as we believe, because it would have been hopeless to attempt its realization, in the present condition of this country. The Dublin Exposition, of which the intended tribute was to have been the memorial, consisted of two distinct elements—a purely industrial one, and an artistic one—and it is difficult to say which was the more important. The committee of the Dargan Institute, therefore, in changing the destination of the funds placed at its disposal for the original purpose, and applying them to the foundation of a Gallery of Art, will have only changed an impracticable scheme into a practical and eminently useful one, at the same time that the propriety of the testimonial will in no degree be diminished.

One of the causes assigned for making this change was, that there already existed in some of our institutions the means for supplying the want for which the Dargan Institute was originally proposed. So far as our knowledge extends, no such means are to be found in any of our existing institutions, and we are therefore led to believe that the committee alluded to the probable extension to this country of the proposed systems of industrial education which the wants of the industrial classes in England has led the Government to commence the organization of. If such be the case, it is time to consider what the probable nature of that system will be, and how far it will be suited to our peculiar circumstances, and in accordance with the spirit of progress. Generally speaking, in Ireland, those measures which are destined to exert an important influence upon the social condition of the country, (apart from all political considerations, appear to excite but little attention), are canvassed but by few, and hence are soon buried in oblivion in the war of parties, until some unforeseen circumstance, perhaps some dreadful catastrophe, like the famine of 1848, awaken men to the importance of other struggles than those of parties. Such, we hope, will not be the fate of the question of industrial education, and that it will receive that share of the public atten-

tion which its immense importance to the welfare, in every sense of the word, of the nation demands.

In using the expression, Industrial Education, we are aware that we are employing a term, the proper definition of which has not as yet been settled. Nor are we going to attempt the task, because, for the objects we have in view in the present paper, we believe the public has already a sufficiently distinct idea of the matter; and these we might thus describe: Science makes us acquainted with the various forces of Nature, the conditions under which they act, and the nature and uses of the mineral, animal, and vegetable substances which we find around us. Man by his industry—that is, by the application of his labour and his empirical knowledge—uses those same forces, so far as they are known to him, to convert these materials into buildings, clothing, or food. One set of men possess the science—that is, the true knowledge—but making no direct use of it themselves for the ordinary purposes of life, it has come to be called *abstract science*—that is, knowledge of the laws of nature separated from, or, in other words, without reference to their uses. Another class, which comprises the greater part of mankind, possess an empirical knowledge of the forces of nature, and of mineral, animal, and vegetable substances, chiefly with reference to their uses; but know nothing, or very little, about the true nature of those forces, or materials, or of the action of the former upon the latter: they know that a current of water is possessed of a certain force, which if applied to a mill-wheel it will turn it, but they do not know the precise laws which regulate its motion, and are thus unable to derive all the advantages from it which they otherwise might. What more reasonable conclusion to come to, than that, if we could combine in one individual the abstract science of the one and the practical knowledge of the other, the world would be considerably benefited by the union? To effect such a result, we have merely to instruct those persons who intend to become manufacturers, or to conduct factories, in science, previous to their entering upon the duties of their calling—this would be *industrial education*.

This view of industrial education is perhaps different from that usually entertained, for judging by much that has been written upon the subject, one would imagine that there are two kinds of science—abstract and practical—a conclusion which would lead to very erroneous results. Whether we investigate the chemical laws of vegetation for the sole object of increasing our knowledge of the operations of nature, or for discovering the best means of increasing our supply of food, it will make but little difference, the results to science will be the same. And although we are far from denying that the highest and noblest aim of science is truth alone, and for its own sake, we are not of those who believe that that end is incompatible with its application to practical purposes, or that it is necessary to divide it into two distinct branches, leaving to one set of men the pursuit of the abstract, and to the other the practical. As in every other occupation of mankind there is a necessity for division of labour, so in science there will always be men who will prefer, like the pioneers of the West, to cut new paths in the unknown wilderness, and some who will be content to

widen and perfect the paths thus traced, and open them to the world. It is well that this should be so; but it should not be made a pretext for classifying science into two distinct branches. The narrow track of yesterday becomes a great highway to-day—that which appeared most abstract and unconnected with life becomes at once the most fertile source of practical results.

In the middle ages science was the privilege of the few, and although we have no reason to doubt that it had disciples with as noble aims as any of our modern philosophers, how small was its progress. But in this age it is becoming the right of all; the chasm which existed between the abstract and practical is gradually being removed, and behold the splendid results already achieved. To attempt to keep up so arbitrary a distinction as that which is supposed to exist in science, is to condemn, on the one hand, science and its professors to a complete ostracism, thus shutting them out from all participation in the great physical progress of mankind, while, on the other, it impedes to a certain extent that progress, in consequence of the slowness with which the results of their labours are assimilated by society.

Assuming, therefore, the basis of industrial education to be abstract science in its widest acceptation, and not the elegant extracts to which some persons would be inclined to restrict it to, our readers might be inclined to say:—But the basis of our University education is abstract, and yet you state that the means of obtaining an industrial education are not to be found in any of our existing institutions? Both conclusions are compatible; it is perfectly true that the science taught in universities would not materially differ in nature from that of the purely industrial college, but it would in quantity, and especially in the relative amount of each branch of science which should be taught. Every educated man ought to be acquainted not alone with the classical languages and literature of antiquity, which, with theology, and what was designated philosophy in former times, constituted the sole intellectual food provided by universities, but with modern languages and literature, and have such a knowledge of mathematical and physical sciences as would enable him to understand the great laws of nature and the methods of investigating them, so as to be able to keep pace with the period in which he lived; and finally, with so much of economical and legal science as would enable him to understand his duties and obligations to society. An education of this kind would no doubt enable a man, should he afterwards become a manufacturer or a merchant, to learn the details of his business much quicker than one who had only received the limited education of a school. But the amount of chemical knowledge of a general character which would suffice for an educated man, would do but little to help a soap-boiler or a smelter to improve his processes. Would it not be a hardship to compel a young man attending a university, and perhaps destined to be a barrister or some other similar profession, to study mathematics and geology sufficient to become a scientific miner, or mathematics and physics to be a good machinist, or to force the miner to learn the commercial laws of different nations, although a necessary element in the education of a merchant?

Universities such as those now existing do not then supply the means of industrial education, and unless we would divert them from their legitimate uses, another institution must be provided, where the miner, the chemical manufacturer, the flax spinner, the machinist, will be taught the necessary amount of science suited for his trade.

Our definition, without presuming to be perfect, will serve to render the subject intelligible to our readers, but a perfect and a successful system of instruction for such an institution can only result from considerable experience, and a union of much intelligence. Our readers will therefore understand, that we are not about to discuss the details of such a system, but there are several points connected with it, which it is of the greatest importance that the public should take into consideration before such a system is founded amongst us; and to these points we shall now direct their attention.

The circumstances of Ireland taken in an industrial point of view are very peculiar. With one exception, this country has no great manufactures, which would render it necessary that the industrial system of education should be adapted in a special manner to them. We have a great many mines, and it would, undoubtedly, be of great moment, that a number of young men should be educated in those branches of science, connected with mining engineering, who would subsequently become managers of mines; but Irish mining industry is not of sufficient importance to call for a separate system for their education. To keep up the supply of competent mining captains for all the mines now in operation in Ireland, and making due allowance for the probable future increase of this branch of industry, not more than five pupils would be annually required, which with a course of study of three years, would give a contingent of fifteen pupils in the third and succeeding years, a number which would perhaps also represent those who might be occupied in metallurgical operations, such as the smelting of lead, iron, &c. The total number then of pupils connected with mining and metallurgy which could be anticipated, would not exceed more than thirty, which it is needless to observe would not justify the establishment of a separate provision for their education, although it might entitle them to receive separate courses on the special applications of chemistry and geology to mining industry, in an establishment founded for general industrial education. The organization of Irish industry is a work yet to be done, and consequently, any system of education established in this country must be of a kind to assist in that organization. It must then be of a general character, and suited to the wants of all classes of the community, basing itself upon agriculture, which must always, from the peculiar circumstances of our resources, form the groundwork of all successful industry in Ireland; it must teach the proprietor and large cultivator those branches of sciences which bear upon the cultivation of the soil, the growth of vegetables, and the rearing of animals. It should also enable the agriculturist to learn the connection subsisting between certain of his crops used as raw materials, and the manufactures in which they would be employed, such as flax, beer, oleaginous seeds, &c., and thus shew him how to meet the requirements

of the manufacturer; whilst, on the other hand, the flax-spinner, the sugar-maker, and oil-man, should not only be provided with the facilities for acquiring a thorough knowledge of the chemical and mechanical principles which would be essential to his business, but might also become acquainted with the general agricultural relations of the crops which serve as his raw materials.

The mineral wealth of a country, taken in its usual sense as meaning metallic ores, form, where they abundantly occur, a great source of wealth; that the educational wants of persons engaged in this branch should be provided for, may be taken for granted, and we therefore leave them out of consideration. But there are many other kinds of mineral wealth besides metallic ores, and as they are generally found near the surface, and thus come as it were within the domain of the agriculturist, it is necessary the latter should become acquainted with their properties and uses. In this category come marbles, limestones for making cements, clays and sands adapted for pottery and glass making, &c. Here are sources of wealth to the landowner, often nearly equal in value with his rents; and yet how few are possessed of even the information necessary to be able to distinguish them. A course of agricultural instruction of the higher kind should, then, include a knowledge of the mineral raw materials of the country. The diffusion of this information in Ireland would give an immense impulse to the branches of manufacture founded upon such raw materials, as, for example, those of earthenware, glass, cements, &c.

Such would be our ideas of one branch of industrial education. With regard to manufacturing industry, properly so called, or technology, in its widest sense, it should be as fully provided for. No matter what a man's trade might be, any industrial educational system established in Ireland, should be in a position to supply him with the scientific knowledge necessary for the successful prosecution of his business. It should, therefore, be complete in all its departments. Let not our readers imagine that we would look for a great and expensive machinery; completeness does not, to our mind, consist of immense buildings, numerous professors, or of imposing masquerades for the granting of pieces of parchment, but in the capacity to instruct in every branch of science which may be deemed essential to understand the nature of raw materials, the processes, chemical and mechanical, through which they are made to pass, and the construction of machinery. The basis of all true industrial instruction is mathematics, not alone because it is of direct use in almost every branch of trade, but because it imbues the mind with juster notions of numerical relations. To the miner and machinist, the flax-spinner, the iron-founder, mathematical knowledge is absolutely indispensable to the proper management of his business, and there are few trades in which it would not be of occasional service. We would, therefore, place that subject as the first on our list of those branches of science which should be taught in an industrial school; and in this we are strengthened by the example of every Continental country which has yet established such a school. Equally general in their importance with mathematics stand mechanical philosophy and general physics; for while a knowledge of the laws of

motion, and of the action of heat and light, &c., are indispensable to the machinist, the miner, the sugar-maker, and other trades, it is of great value to the agriculturist. Of the importance of chemistry it is unnecessary to speak, for we know of no manufacture in which chemical action is wholly absent, and a great many are purely chemical processes. Mathematics, physics, and chemistry, then, constitute the common elements of all industrial education, which if not completely indispensable to every manufacturer, are at least useful in some degree to all.

The other branches of science which should form part of a system of education, would have only special application to certain branches of trade. Among these, geology and mineralogy would be indispensable elements in the education of the miner; and geology, botany, and natural history in that of the agriculturist, who would also require to be taught his still more special subjects of practical agriculture, veterinary medicine, and the hygiene of animals. Under the head of technology, would be included a series of special courses upon milling, weaving, and other operations connected with the manufacture of textile fabrics, manufactures in metals, pottery, &c., adapted to the wants of those intended to pursue those different branches of industry. And finally, the merchant and manufacturer would derive considerable benefit from a knowledge of commercial law and statistics.

In some recent articles of great ability which have appeared upon this subject, and among others in an Irish periodical of considerable influence, it has been suggested, that in the event of a great industrial university being founded in London, the Irish and Scotch colleges of the same kind might be made secondary schools, from which the professors might be promoted when deserving, to the central establishment, and that the more promising students from Ireland and Scotland might also spend a session there. Centralization of institutions, whose character should be local, has always been impolitic and injurious; but the centralization of the educational system of one country in another is simply absurd. If such a system were adopted, we can only say, that it would seal the doom of the Irish institution, and the expense of its erection may in such case be spared. And so far from thinking that it would be a boon to promote the Irish professor to a chair in London, we would consider it a very serious loss to the country to lose her best sons precisely when they were of most value.

There is another point to which public attention should be directed, which is this: all classes in Ireland stand in need of industrial education, and while we freely admit that the superior education of which alone there is question here, would necessarily be taken advantage of, chiefly by the middle classes, still we think that in justice to the artisan it should be made so cheap, that no barrier should be raised to prevent his taking advantage of it. All education adapted for the middle classes is too expensive in Ireland, if we consider the mean income of that class; unless, therefore, the lowest possible rate be fixed upon, any new system of education will be a failure. There is another reason, too, why the expense should be small—when the money of the state is applied for educational purposes, it should be so employed that no monopoly be created

for the benefit of a class. If a good industrial college be established, there can be no doubt that in a few years the pupils of that school will be preferred as mining captains, managers of estates, superintendents of factories, and other similar offices. If the education provided by that institution be expensive, it will virtually give to the middle classes the monopoly of all those places to which at present deserving workmen may attain. There is of course a remedy for this by the municipal authorities of towns founding free scholarships, to be granted to superior merit; but judging from the preference given by nearly all civic functionaries in these countries to "state dinners," masquerading shows, and similar nonsense, there appears at present but slender hopes that so important and progressive a step will be taken.

If industrial education must be cheap in order to be successful, we may say with equal truth, that its teachers must be well paid. In these countries the worth of a man is estimated by his pay, and if we judge by this standard, the most worthless people are those to whom is entrusted the education of the people. This rule not only applies to the humble teacher of a country school, but to the most eminent professors of colleges. A simple clerk in a government office very often receives three or four times the amount of salary which is thought liberal for a professor of a college. If an eminent barrister is appointed to some place, less than £1,000 a year would not be offered him, and even the obscure members of the legal profession can readily obtain from £500 to £700 per annum. But the moment a scientific man is in question, £300 is considered to be the equivalent of his services, no matter how brilliant, while the junior members are considered to be sufficiently paid if they receive the salary of a draper's assistant. We have selected the government rewards for scientific and literary services, not because they are exceptions to those conferred by the public, but because they show the standard by which the latter judge of the value of education; and as long as that remains, such as it is, we can scarcely believe that the public is seriously desirous of either intellectual or industrial education. We ask of our readers to consider calmly and earnestly the points which we have endeavoured to bring under their notice. One false step made in the beginning would precipitate us again into the slough from which we have already made some successful efforts to escape. Let them ponder well over this fact, that to be an educated people is, to be respected—to be prosperous—to be independent.

ART. III.—*On the Artificial Oyster Beds of Lake Fusaro, and on the Importance of adopting a similar method on other Coasts.* By M. COSTE.

[Translated from the original Memoir in the *Comptes Rendus* of the Academy of Sciences, No. 19, May, 1853.]

At the head of the Gulf of Baia, between the shore and the ruins of the city of Cumæ, are still seen the remains of two ancient lakes—the Lucrine and Lake Avernus—formerly communicating by a narrow channel, of

which one, namely, the Lucrine, gave access to the waves of the sea, through the opening of a dyke upon which passed the Herculean Road—two calm basins, which an upheaving of that volcanic soil has almost completely filled, and in which, in the language of the poets, the sea seemed to take refuge for repose. A crown of hills, bristling with savage woods, flinging their deep shadows over the waters, made of them an inaccessible retreat, which superstition consecrated to the infernal gods, and whither Virgil conducted his hero Æneas. But about the seventh century, when Agrippa had stripped them of their luxuriant vegetation, and the subterranean path (the grotto of the Sybil) was hollowed out, which led from Lake Avernus to the city of Cumæ, the myth, unveiled, disappeared before the works of civilization. A forest of splendid villas, built and adorned with the spoils of the world, took the place of those gloomy thickets. All Rome repaired to this sojourn of delight, attracted by a sky so soft and by a sea of azure. The hot, sulphureous, aluminous, saline, and nitrous springs which trickled from the crest of these mountains became the pretext for the emigration of those patricians whom *ennui* chased from their idle homes.

Industry exhausted her resources to accumulate around those patricians all the enjoyments which their effeminacy led them to seek; and among those who devoted themselves to this enterprise, it occurred to Sergius Orata, a man of wealth, elegance, and agreeable manners, and who possessed great credit and reputation, to organize beds of oysters, and to bring this shell-fish into fashion. He caused them to be brought from distant parts, and succeeded in persuading all the world that those which he reared in the Lucrine lake had there contracted a flavour which rendered them superior to those of Avernus, or even of places more celebrated for their oysters.

His opinion prevailed with such rapidity, that, in order to supply the consumption, he ended by occupying almost the entire circumference of the Lucrine lake with buildings designed for keeping them, possessing himself in this manner of the public domain with so little moderation, that they were obliged to institute a suit against him to dispossess him of his usurpations. At the time when this mishap befell him, and to express the degree of perfection to which he had brought this branch of industry, it was said of him, in allusion to the hanging baths, of which he was also the inventor, that if he was prevented from rearing oysters in the Lucrine lake, *he knew well how to breed them on the very roofs themselves*. Sergius, in fact, did not confine himself to the organization of oyster beds; he had created a new species of industry, the practice of which is still applied some miles from the spot where he carried it on. This is a fact, at least, which I hope to demonstrate a little farther on.

Between the Lucrine lake, the ruins of Cumæ, and Cape Misena, lies another salt pond, of about a league in circumference, from two to three metres (six and a-half to ten feet) in depth, at the bottom muddy in consistence, volcanic in nature, blackish in colour, not less celebrated than the first named lakes,—in fine, the Acheron of Virgil—which now bears the name of Lake *Fusaro*. Round all its circumference—and no one knows at what time this industry had its origin—are seen, at certain distances,

spaces, generally circular, occupied by heavy stones, placed there in imitation of some kinds of rocks, which are covered with oysters of Tarento to such an extent as to transform each of them into an artificial bank of that mollusc. About forty years ago the sulphureous emanations of the crater occupied by the waters of Lake Fusaro, having reached too great a degree of intensity, the oysters of all these artificial banks perished, and in order to replace them, new ones had to be brought there.

Around each of these manufactured rock-clusters, which are generally two toises (about twelve feet) in diameter, stakes have been firmly planted, sufficiently near each other so as to embrace the space in the centre of which the oysters settle. These stakes rise a little above the surface of the water, so that they can easily be grasped with the hands, and plucked up when that becomes necessary. There are others also distributed in long files, and bound together by a rope, to which are suspended faggots of brushwood, intended to multiply the moveable pieces which constitute the mechanism for gathering the harvest.

When the season of spawning arrives, the oysters lay their eggs; but they do not abandon them like the greater number of marine animals. They retain them in process of incubation in the folds of their mantle between the bronchial plates. Here they remain immersed in a mucous substance, which is necessary to their evolution, and in the midst of which their embryo development is effected.

After the bursting of the ova, the mother ejects the young ones, who, being already armed with a swimming apparatus, are enabled to spread themselves afar to seek some solid body to which they may attach themselves; this apparatus, formed by a deciduous ciliated lip, was discovered by Dr. Davaine, and described in the remarkable work which he undertook and executed under the auspices of our colleague, M. Rayner.

The number of young which are thus ejected each time from the mantle of a single mother, reaches not less than 100,000, so that, at those seasons in which all the adult individuals composing a bank allow their progeny to escape, this living dust is exhaled like a thick mist, which leaves the hearth whence it emanates, and which the waves disperse, leaving upon the parent stock but an imperceptible portion of what it has produced. All the rest is scattered, and when the swimming apparatus drops off, and thus destroys the power of locomotion in these myriads of animalculæ, they sink to the bottom, where the greater part become the prey of the polypi fixed to the soil.

A great service would undoubtedly be rendered to industry if means were furnished to avoid this immense waste and to fix the whole of the harvest. The practice of Lake Fusaro, if we knew how to extend its application, would confer upon it this benefit. The object of those stakes and these faggots, with which the artificial banks are there surrounded, is precisely to stay in its passage this propagating dust, and to present surfaces to it to which it may attach itself, as a swarm of bees to the trunk of a tree, where the colony fixes itself on abandoning the hive.

It does, in fact, fix itself upon them, and grows there in size so rapidly, that in the space of two years each of these living corpuscles of which it is

composed becomes eatable. Then the stakes and faggots are lifted out of the water, and all the oysters arrived at maturity picked off in succession, and the fruits of these artificial grape clusters having been thus gathered, the apparatus is replaced until a new generation produces a second harvest; at times, without touching the stakes, the oysters are simply detached by means of a many-forked grappling hook.

The source from which spring these generations remains there permanent, perpetuating and renewing itself without ceasing by the annual addition of the small number which does not desert the place of its birth. Curious branch of industry!—of which I have been enabled to study carefully the entire practice, thanks to the obliging assistance of our learned colleague, M. Bonuci, Inspector General of the Crown Monuments, who was kind enough to accompany me throughout during my exploration of the gulf. It yields to the Civil List, notwithstanding its restricted application, a revenue of 32,000 francs (£1,280); but it would be very differently productive if the property of the lake should pass from the disinterested hands of the Prince into those of speculators. The importation of this branch of industry into the salt ponds along our coasts would unquestionably be a source of real wealth for our population; extended, with some modifications, to the working of the natural banks which exist in the bosom of the seas, it would assume the proportions of an enterprise of general utility. I shall proceed to show in what manner.

In comparing the practice of Lake Fusaro with the mode of treatment of the natural oyster banks lying in the bed of the sea, it is not difficult to perceive that, if the latter system is not put an end to, the source of production will be infallibly exhausted. Speculation, in fact, without taking any care of coming generations, which it would nevertheless be so lucrative to retain and preserve, occupies itself solely in perfecting the instruments which it employs to tear the superficial layers from the beds of oysters which it brings into our markets. Its genius is only applied to render the means of destruction more efficacious; for these layers are precisely those where the young ones grow who have not at their birth abandoned the parent stock. Now, since it attacks with equal power of destruction what is old and what is new, it follows that any bed whatever is fatally destined to disappear by the very working of it; while it would be possible to obtain from it harvests incomparably more abundant without ever touching the parent stock which produces them; that is to say, what at the present day forms the only resource of this branch of industry.

In order to attain so important a result, it would be sufficient to make use of the method employed with so much success in Lake Fusaro, introducing, however, what modifications the peculiar circumstances of the new locality might render necessary. A number of wooden frameworks, composed of a great number of pieces, might be constructed, weighted by stones solidly attached to their base, bristling with stakes firmly fastened on, and armed with iron cramps; as soon as the spawning season would have arrived, they might be let down into the bottom of the sea, either directly on the oyster beds, or placed around them. They should be allowed to remain there until the *reproductive dust* had covered the different pieces,

and might be subsequently withdrawn, whenever it might be deemed desirable, by means of cables attached to a buoy floating on the surface of the water to mark their position.

This species of moveable banks could be transported to those localities in which experience should have demonstrated that oysters rapidly increased in size and gained a full flavour; or they could even be placed in some lagoon or channel, where they would always be found at hand, as in a laboratory.

Already M. Carbonnel, struck by the destruction of this branch of industry, has endeavoured to call the attention of the Government to the necessity of creating upon our coast line new banks of oysters. This useful project certainly deserves to be taken into consideration; but the question of the permanence of this repopling of the oyster beds will not be definitively resolved save by the adoption of a mode of working analogous to that which is practised from time immemorial in the Gulf of Naples, and by making the salt pools and lakes such as the basin of Arcachon, and the lagoons of the Mediterranean, available for the production of the article.

I have said, at the commencement of this memoir, that the industry of Lake Fusaro was known to the ancients, and that Sergius was probably its inventor. There is indeed a historic monument of antiquity, which tends to prove that it ascends perhaps to the time of Augustus, or that of the orator Crassus, before the Marsian war.

In the neighbourhood of Florence has been discovered a vase of ancient glass, illustrated by Sestini,* and upon which is seen the representation of a fish pond, communicating by arcades with the sea. We read on the vase: *Stagnum palatium*; and lower down: *Ostrearia*.

What chiefly strikes the eye in the drawing of this fish pond is the disposition of the stakes, laced together in different directions and disposed in circles, which were evidently placed there but to receive and guard the offspring of the oysters. The industry of Fusaro is then but a practice invented by the ancient Romans, continued by their descendants, and which was for Sergius Orata,—*Luxuriorum magister*, as Cicero calls him,†—the source of an immense revenue; for, according to Pliny, it was not solely for his pleasure, but also through love of gain, that he devoted himself to this enterprise: "*Ostrearum vivaria primus omnium Sergius Orata invenit, in Bajano, atate L. Crassi oratoris, ante Marsicum bellum; nec gula causa sed avaritia, magna vectigalia tali ex ingenio suo percipiens.*"‡

* *Illustrazione di un vaso antico di vetro, trovato presso Populonia.* Firenze, 1812.

† *De fin.*, l. 2.

‡ *Hist. natur.*, l. ix., c. 54.

ART. IV.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c. and of Discoveries in general science bearing upon Industrial Arts.*

Thomas's Patent Linen Power Loom.—Mr. E. Thomas, who is the manager of Messrs. Kennedy's factory, in Belfast, in superintending the erection of some muslin power looms for that firm, was struck with the idea, that by the substitution of another substance for the emery beam, by which the muslin is taken from the reeds, and with some other alterations, the loom might be adapted for linen weaving. He accordingly set himself earnestly to work, and the result of his invention was the patent beam, which now bears his name, and which is calculated to remove the hitherto insurmountable difficulty of taking away the cloth from the reeds, with the regularity required, and to enable linen to be woven with the positive taking-up-motion, which effectually coils up the cloth, as each end of the web is thrown in; is perfectly uniform, and can be varied to suit any number of picks or shots, with the greatest possible regularity "in count," without being subject to the slightest variation, through negligence or inattention on the part of the weaver. In former methods, independent of an increased friction or traction on the yarn, it was necessary, we are told, to employ a workman at high wages, who could alter the wheels at the end of the loom, so as to preserve an uniformity in the weaving. But substituting, as Mr. Thomas has done in his invention, a cast iron beam for the emery one used in the weaving of cotton cloth, the linen is taken effectually and regularly away from the reeds as woven, and the weaver has no ratchet-wheel to distract his attention; but is enabled to attend to two looms, and to work almost any yarn that can now be wrought by hand, with the greatest ease. The invention is very simple, and will no doubt contribute very materially to the future progress of the linen trade, which is now entering upon a new era.—*Belfast Mercantile Journal, January 10th.*

Tachometer for Railways, by Deniel, Traffic Superintendent on the Montereau and Troyes Railway.—The object of this tachometer is to enable the directors of a railway to know the exact mode in which the engine driver has driven his engine. It indicates the time of starting, the duration of motion, the rapidity of speed, and its increase and diminution, and thus prevents all neglect of duty on the part of the driver. But the latter also derives advantage from it, for he has always the satisfaction of having before his eyes an indication of his speed, which enables him to follow punctually the rules laid down for him. Finally, by a simple inspection of the diagrams, which are self-registered by the apparatus, the directors are enabled to know how the servants of the company perform their duty at each station, with regard to the times of arrival and departure of the trains, inasmuch as each fact of this kind is marked on the chart of the tachometer.

The principle of the apparatus is also so very simple that there can be no doubt great advantages may be derived from its use. It consists of two well known elements, the first, a pendulum, which is similar to the centrifugal pendulum, and in which the action of gravity is replaced by that of elasticity. The axis of the pendulum is placed horizontally, and has fastened to one of its ends, by means of a ring screwed to it, four bar springs; the other ends of those springs are attached to another ring, which slides upon the axle, and is thus capable of communicating motion to a lever; on the middle of each spring is attached a small copper ball, for the purpose of increasing the effect of the centrifugal motion. When the pendulum thus contrived is at rest, the straight springs lie flat upon the axle, but when the latter is set in rapid motion, by means of a strap passing over one of the axles of the locomotive, the brass balls upon the springs will receive a centrifugal tendency, which will gradually overcome the force of the springs, which will then bulge out in the centre, and in doing so, will draw the sliding ring along the axis; originating in this way a horizontal motion, the amplitude of which depends upon the velocity of rotation of the axis of the locomotive, with which the apparatus is put in connection. This horizontal motion is communicated on the one hand to

an index which moves up and down before a graduated scale, and thus indicates the speed of the engine; and on the other, to a pencil point held in a kind of forceps, which registers that speed upon a sheet of paper. The whole apparatus is, in fact, somewhat like the ordinary governor of a steam-engine, the motion being applied to a pencil point, instead of the throttle valve.

The second element consists of a system of clock-work, which is so arranged, that the principal axis for the termination of its revolution, and which would correspond to the hour-hand of a watch, takes a given amount of time to complete a single revolution, the duration of which is determined by the usual time occupied by trains running from one terminal station of a line to the other, and which may generally be set down at from five to six hours. This chief axis carries a vertical plate, on which a sheet of paper is fastened, and which is arranged in the following way: a number of concentric circles are drawn upon the paper, each circle representing a unit of speed, say a mile. If we suppose the pencil point above mentioned, to mark the external circle, it will mark repose; the smallest or innermost circle on the other hand, indicates the highest speed which the apparatus can register. These concentric circles are divided by a number of radii, each of which marks a minute, when the plate requires six hours to make a revolution, the circle must be divided into 360 parts. The arcs of each circle corresponding to minutes, may be further subdivided into halves and quarters of minutes.

The pencil point, which receives its rectilinear motion from the centrifugal apparatus above described, is kept in contact with the sheet of paper by means of a spring, the point where it touches the paper when the engine is at rest, or the *point of repose*, coinciding with the circumference of the outermost circle. It will be at once understood, that the pencil point, under the combined influence of its own rectilinear motion, and of the circular motion of the sheet of paper produced by the clock-work, will trace on the paper a waved curve of motion, the ordinates from which, drawn to the larger or outermost circle, will represent the speed of the engine; while the arcs intercepted between the radii, passing through the point of repose, at which the pencil stood at the first departure of the train, and the point to which it reached on arrival at the terminus, will mark the duration of transit.

But it is not alone the different rates of speed of a train which it is important for the directors of a railway to know, but also the exact moments of arrival and departure at each of the intermediate stations of the line. As, however, the apparatus cannot indicate a speed of less than from six to seven miles per hour, in consequence of the smallness of the centrifugal force produced by small velocities, such small velocities could scarcely be distinguished from absolute repose. The apparatus, therefore, left the superintendent in doubt as to the moment of arrival of a train at an intermediate station, and consequently gave no information as to the fulfilment of duty and order of the company's servants along the line. By a very simple combination, however, M. Deniel has succeeded in perfecting his apparatus in this respect also, and the result is, that the apparatus registers on the paper, not only the exact limits of absolute repose, but each movement affected in the position of a train at a station, the exact moment it took place, and its duration.

Finally, in many cases it may be interesting to know the exact time at which the engine driver received the signal of departure from a station. For this purpose, a kind of clock is enclosed in the case containing the tachometer, the lever which sets the striking part of which in motion communicates at the same time a sliding motion to the guide rod of the centrifugal pendulum, and consequently to the pencil point, which thus marks a line in a direction towards the centre on the paper. This line shews by its position the precise instant at which the signal was given; and when a white space is observed between this line and the one marking slow speed, it will indicate that the engine driver delayed starting during the time represented by the white space. This part of the apparatus is not necessary to the proper working of the remainder, and it may often happen that its use is dispensed with. It is, however, an element of great importance for those lines whose cost of working is a subject of discussion.

In the front of the apparatus is placed a scale the divisions of which indicate the speed, and the value of which is determined in the first instance like that of the diagram paper, on which the curve of motion is described by experiment; this is the

engine driver's indicator. We recommend the use of this machine to the directors of our railways, as a most effectual check upon the working of the lines, and as an additional security for life. Those who wish to examine further into the matter, and to study the drawings of it, will find a full account of it in *Förster's Bauzeitung*, 1853, p. 31.

Self-acting Oil Apparatus, for Greasing the Axles of Locomotives, Railway Carriages, and Machines generally.—The greasing of the axles of locomotives or of other machines, and in fact of all revolving or sliding surfaces, with tallow or a mixture of palm oil and tallow, or other solid fats, is only effective when the grease melts and descends by the hole made in the bottom of the grease-box, and spreads itself over the surfaces to be greased. But as the grease does not melt until the surfaces in contact get heated from the friction, that is, until the evil to be guarded against has taken place, a considerable amount of the available power is lost in wearing down the rubbing surfaces. The use of tallow or palm oil for lubricating has consequently been to a great extent given up, and oil substituted for it, wherever that has been possible. Still the employment of oil is also attended with many disadvantages, for although it readily flows from the grease-box upon the surfaces to be oiled, and thus prevents any heating of the parts from taking place, so long as there is a supply of oil in the reservoir, yet it flows so very rapidly, that unless care be taken to keep up a constant supply of oil, the evil to be avoided becomes greater than even with tallow. The use of oil can therefore only be adopted in particular cases, where an attendant is always at hand to keep up the supply, whenever the necessity of such becomes apparent. Various attempts have been made to perfect the greasing by oil, by rendering it continuous. For example it was proposed to place some cotton wick in a hole in the bottom of the oil reservoirs, and to allow the other end of it to fall upon the spindle or other part to be greased, so as to form a kind of syphon, and thus by the capillarity of the wick produce a constant flow of oil, which after having lubricated the surface dropped into a small cup placed underneath, from which it was returned from time to time into the reservoir. This method, although a considerable improvement upon the old one, was also very imperfect, because the slightest difference in the diameter or length of the wick produced considerable variation in the quantity of oil distributed upon the surface to be greased, hence in the negligent hands of the persons usually attendant upon machinery, who are always perfectly satisfied with a rough approximation, the proper oiling would be sure to be neglected, and besides, the wick itself would also be liable to get clogged, especially where inferior oil would be used. Another plan tried was to place a reservoir of oil beneath the axle, into this dipped one end of a piece of wick, the other being kept against the axle or other part to be greased by means of a lever with a counterpoise, the oil then mounted by the capillary action of the wick and distributed itself over the surfaces to be lubricated. The same objection which applied to the other application of the wick, has also been found to affect this one, perhaps even in a stronger degree, as the wick got clogged very soon, and all ascent of oil ceased.

Small hollow cylinders of copper, made to float on the surface of the oil in a reservoir placed underneath the axle-box, so as to come in contact with the axis in motion, and thus by contact supply it with a sufficient quantity of oil, have also been used. Cylinders of wood have likewise been employed for the same purpose, but neither appear to have been very successful, one great objection being, that as soon as the oil fell below a certain level, contact between the cylinder and the axle ceased. F. Busse, chief superintendent of the Leipzig and Dresden Railway, considers the cause of this failure to have been that the cylinders were too small, and he accordingly has introduced cylinders of wood previously steeped in strong glue, of as large dimensions as possible. He considers that these cylinders should be as large, at least, as the axle, and if there is room enough they might be made even still larger. The application of his new mode of oiling he states to be very simple: the oil reservoir consists of a cavity in the lower part of the axle-box, provided with an aperture, into which is fitted a tube, by means of which it can be filled to the proper level, and which serves at the same time to indicate, at any moment, the height of the oil in the reservoir. The excess of oil flows from the

neck of the axle into the oil vessel, from which it is again raised by the revolution of the wooden cylinders.

In using such a contrivance, it is recommended that the first oiling should take place in the usual way, by the opening in the top of the axle-box, until the new surfaces had ground themselves true. Busse proposes to mix the oil employed with this apparatus with some cheap ethereal oil, such as coal oil, (Young's paraffine oil, or the corresponding products from turf, would answer excellently), to the extent of 25 to 30 per cent. By this means the oil is kept very fluid, greases better, leaves the sediment deposit, and does not freeze. The thick impure oil, which is found in the bottom of the oil reservoir when cleaned out, he puts into a vessel, and adds a sufficient quantity of ethereal oil, stirs the mixture well, allows it to settle, and syphons off the clear portion, which he uses for mixing with fresh oil, and in this way he recovers nearly the whole of the impure oil, which should otherwise have been thrown away.

The advantages of this system, when applied to railways, Busse considers to be:

1. Freedom from heating in the axles, and consequent removal of all danger on this head.

2. Doing away with the necessity of supplying the grease-boxes at the intermediate stations, and consequent saving of a considerable amount of time.

3. Greater freedom of motion, and consequent saving in the haulage on a line, in consequence of the more complete and uniform oiling.

4. Considerable saving of greasing stuff, as shown by a practical experiment made upon the Leipzig and Dresden Railway. A carriage with two axles and four axle-boxes, each containing $\frac{1}{2}$ lb oil, performed a number of journeys, amounting in the aggregate to about 3,500 miles, without consuming the oil. Busse charges the company a rent of ten pence for each apparatus he attaches to a locomotive or carriage, and for the use of his oil mixture; the cost for fitting it to each axle-box, he states, to be less than a Prussian dollar, or about 3s.

However perfectly the apparatus just mentioned may work upon railway carriages, it appears clumsy when compared with the contrivance of M. De Coster, a machinist of Paris. The principle of this invention is simply to place a kind of washer on the spindle, having its outer circumference immersed in oil, the whole being enclosed in a box. By the revolution of the axis the washer also revolves, and in its rotation carries with it a continuous stream of oil, part of which spreads over the surfaces of the spindles and brasses of the axle-box, and keeps them in the most perfect state of lubrication. One of the greatest advantages of De Coster's ingenious invention is, that it can be applied to all machines, no matter how small, and requires no surveillance of any kind, the one supply of oil lasting for several months. In order to test it, M. de Coster applied his system to the blowing fan of his forge, placing one of the axle-boxes in the masonry of a wall, so that it could not be touched, and thus rendering the experiment more decisive. The fan made 1,700 revolutions per minute, and consumed, by the old system of greasing, 50 kilogrammes (110 $\frac{1}{2}$ lbs.) of neatfoot oil, at two francs the kilogramme, or £4, per annum, and required the constant attendance of a man in order to keep it perfectly oiled, which was a matter of very considerable expense. With the new arrangement it worked six months with one kilogramme (about 2 $\frac{1}{2}$ lbs.) of tallow oil (oleine), which cost only 1 franc 60 centimes, or 1s. 3 $\frac{1}{2}$ d., and which was introduced on first setting it to work. At the end of this period the oil was found to have preserved all its original fluidity, and sufficient of it still remained to last for a considerable time longer, if the experiment had been continued, which was not the case, in consequence of the fan having been dismantled to make room for a foundry, which was being erected in the same place.

The principle advantages of M. de Coster's system are: 1, perfection and regularity of oiling; 2, complete saving of the expense of renewing the plummier-blocks of axle-boxes, &c., which in consequence of being always separated from the spindle by a film of oil, scarcely wear; 3, complete absence of all heating, because independent of the absence of all wearing action, the washers in their rotation act in some degree as a fan in producing a current of air, which enters by a small orifice at the side, where the washer issues from the oil, and escapes from a similar one at the opposite side, where it descends into the oil, and thus cools the apparatus; 4, considerable diminution in the dimensions of all the organs of transmission, such as shafting,

connecting-rods, &c.; and hence, 5, a saving of power in transmission, and consequent possibility of transmitting it to a much greater distance; 6, a considerable saving in fixing the foundation of large machines, by making them lighter; 7, enabling the power to be transmitted underground, and beneath the flooring, and not through rooms and workshops, as at present, in consequence of the constant necessity of oiling the spindles and brasses of axle-boxes, and keys of shafting, &c., a result which would conduce to cleanliness and order, and be a great saving of room; 8, and lastly, the power of increasing the speed of the prime mover, without a corresponding increase of power or wear and tear, and thus doing away to a great extent with the necessity of cumbrous pulleys, and other means of multiplying speed.

We shall, perhaps, return on another occasion to the discussion of the important result which such a system of oiling would lead to, in reducing the weight and dimensions of shafting and other organs of transmission. *Further details upon Busse's system may be found in the Eisenbahnzeitung, 1853, p. 71, and upon De Coster's system in Le Technologiste for October, 1853.*

It will not be out of place here to mention, that another form of self-oiling axle-box has been patented in England, by Mr. Paul R. Hodge; he has introduced this apparatus as the best in use in the United States, where no solid fat is employed in the greasing of railway axles. From some experiments made with this new system, under the superintendence of Mr. McConnell, on the London and North Western Railway, it appears that a tender, employed partially in connection with the express train and partially with a goods train, having been fitted with American axle boxes, and supplied with ten quarts of oil, was worked for four months, during which period its aggregate journeys amounted to 5,743 miles, and on being then examined, sufficient oil remained in the reservoirs to serve for 4,000 miles more, whilst five quarts of dirty oil were obtained from an under reservoir, which could be employed for cutting screws, boring, &c. A comparison between the daily cost of the old system of tallow greasing with Normanville's axle-boxes, and the American system with oil, gave for the former 9 pence, and for the latter 1.54 pence, being a saving of 7.46 pence per diem for the tender alone. For full details of this system, we refer our readers to the number of the *Civil Engineer and Architects' Journal* for January, 1853, p. 24.

What is the best mode of Painting Iron Bridges, Gates, and other Iron Work, so as to preserve them from Rust?—The great number of iron bridges now constructed in connection with railways, as well as the general employment of iron in the construction of roofs, gates, &c., renders it a question of great importance to determine what is the best mode of painting them, so as to prevent them from rusting. The usual ground coat applied to such structures is made with red lead; but experience has shewn, that rust rapidly forms under the coating, a fact which can perhaps be in part explained by its composition; that substance being a combination of protoxide and peroxide of lead, gradually parts with a portion of its oxygen to the iron, and causes it to slowly rust. Without pretending to decide what is the best substitute for red lead, it may be useful to many of our readers to learn the process adopted with so much success with the Britannia Bridge, especially as we have observed that the use of red lead is still almost universal.

The iron work is first well scraped with iron instruments, (a most important point,) then brushed with wire brushes, and finally with stiff hair brushes, until the whole surface is perfectly free from rust. The cracks, joints, and points of contact of bolts, &c., are also cleaned out, and every place where water could lodge filled up with the usual cement, made of a mixture of white lead and red lead. As soon as this cement is dry, the whole is again brushed, when it receives two successive coats of paint, at intervals of from 8 to 14 days between each, according to the state of dryness. The paint employed for this purpose consists of 560lbs. of genuine white lead, 133lbs. of raw linseed oil, 18 to 36lbs. of boiled linseed oil (prepared without litharge), and 18lbs. of oil of turpentine. The more of the boiled linseed oil which is employed, the thinner will be the paint, but the less durable also; only sufficient should therefore be taken to render the paint convenient to work with. The same observations apply to the employment of the oil of turpentine, any excess of which would render the colour less durable and liable to crack. While the fourth coating is still fresh, it is dusted over with well washed fine-grained white sand; a little prussian blue and umber is also added to

the paint used in the last coating, so as to give it a light marine grey tint. Such a coating is considered to last for five years, after which it is to be completely removed and renewed. The floor and other parts not visible when perfectly cleaned, as before described, receive two or three coats of the following mixture—8lbs. of coal tar, 1lb. of spirit of turpentine, and 2lbs. of powdered quick lime; the last coat is also sanded. This painting, which is applied for economy alone, is considered to last for two years, after which it is to be fully cleaned off and renewed. Several railway bridges, both in England and on the Continent, have been painted in this manner with white lead, and we believe with perfect success.

Artificial Grindstones.—J. Weld, a manufacturer of Amberg, prepares a peculiar kind of artificial grindstone, with which he has established a considerable trade. These stones are formed of a mixture consisting of 2 parts of bog iron ore, 1 part of sandstone, and $\frac{1}{2}$ part of clay. The bog iron ore is first crushed by stamping, then ground successively in two different mills, much in the same way as china clay is prepared, until it becomes an exceedingly fine powder. The sandstone is crushed between cylinders, and the clay carefully washed and purified; a mixture is then made of these three ingredients in a moist state, in the proportions above given, well worked together, so as to form a homogenous mass, which is then moulded into the desired forms, dried and baked in a kiln.

Another variety of polishing stones of a much finer quality for certain purposes, such as glass-cutting, &c., is prepared by MM. Neppel, of Nevres, whose patent, granted in 1840, is now expired. The basis of these stones is china clay, pipe clay, or other fine plastic clay, the other substances employed being slate, quartz, sandstone, flint, sand, emery, oxide of iron, and iron filings, in proportions varying according to the quality of the stone intended to be produced, from 5 to 20 per cent. All these materials are first carefully selected, and each well purified by levigation and washing. This done, the materials are mixed in the proper proportions, and introduced into a mill, where they are ground with water, an operation which lasts from three to four days, with a mass of from 24 to 3 cwt. When properly ground the mass is passed through a sieve made of copper, the degree of fineness of which depends upon the quality of the stone to be made. The mass is now allowed to slowly dry by natural evaporation, after which it is moistened from time to time, so as to keep it of an uniform plasticity. Previous to employing it, it is well kneaded, then moulded in plaster moulds, rubbed even with sand-paper when taken from the moulds, after which the moulded pieces are allowed to dry very slowly, to prevent them from cracking. When fully dried they are placed in seggars of fireclay, hermetically closed, and exposed to a heat between that employed for firing stone-ware and porcelain.—*Deutsche Gewerbezeitung, Heft 7, p. 415, 1852.*

Karl Karmarsch describes another kind of grindstone, made by melting shell-lac, and adding a proper quantity of emery or fine sand, and pouring the melted mass into moulds. When large rotatory stones are to be made in this way, it is recommended, in order to save the material, to surround an iron drum of nearly the required size, and about an inch in thickness with the mass. In general, however, only small stones are made of this substance, the chief advantage of which appears to be, that it yields by use a very heavy dust, which at once falls, and does not spread about the workshops, to the injury of the health of the workmen, as that produced by sandstones, when used dry, does. This mode of preparing artificial stones has been known for a considerable time, but recently a new and ingenious application of the material has been made by Heinrich Spann of Ham-burgh, in the production of his so called *mineral files*. The usual proportions of sand or emery and shell-lac employed are, 3 parts of the former and 1 of the latter. These proportions must necessarily vary, however, according to the degree of fineness which the files should have. The chief point apparently to be attended to in their manufacture is, that the grains of sand should be of nearly uniform size. These files, which are very cheap, can be used as substitutes for metal files in all cases; they may be used dry or wet, upon wood or upon glass, and in many cases even with oil, indeed, for working with the latter liquid they appear to be better adapted than steel files.—*Mitth. des Hannov. Gewerbevereins, 1853, p. 140, through Dingler's Polytechnisches Journal Bd. 130, Heft. 3, Nov. 1853.*

On the use of Alloys of the more easily fusible metals for Plumber-Blocks, by Karl Karmarsch.—It is well known that plumber-blocks have been recently made of alloys of easily fusible metals, and employed in all kinds of machines, in consequence of the advantage which their employment presents of using the axle end itself as the core for making the mould, and thus saving the expense of boring out the shaft cushions. When the pressure on the spindle is small, a mixture of 17 parts of lead and 3 parts of antimony answers very well, and is at the same time very cheap. Harder ones, capable of bearing a greater pressure, may be made with lead, tin and antimony, or of tin and antimony without the addition of lead. An alloy of tin, antimony and copper is very well adapted for heavy machinery, or those whose axes have considerable velocity of rotation; such an alloy has even been found serviceable for the plumber-blocks of locomotives. Mr. Karmarsch has communicated the following proportions for the composition of such alloys, with the view of directing attention to so important a subject:—

1. *Alloys of Tin and Antimony.*—3 parts, and even up to 5 and 6 parts of tin, have been prescribed for each part of antimony. The antimony is to be first fused with its own weight of tin, and the mixture then poured into the remainder of the tin, melted in a different pot, and the whole well stirred. In this way a more perfect and homogenous mixture of the two metals is obtained, than when the whole of the tin is at once fused with the antimony.

2. *Alloys of Tin, Antimony, and Copper.*—The following table contains the composition of all the alloys which he has been able to procure, arranged according to the proportions of copper, being also the order of their hardness:

						In 100 parts.							
Tin.			Antimony.			Copper.			Tin.	Antimony.	Copper.		
a ...	24 parts	...	2 parts	...	1 part	...	88·89	...	7·41	...	3·70		
b ...	16	"	3	"	1	...	80	...	15	...	5		
c ...	13	"	2	"	1	...	81·25	...	12·50	...	6·25		
d ...	73	"	18	...	8 or 9	...							
						With 8 parts of copper } the proportion would be }			73·74	...	18·18	...	8·08
						With 9 parts do. it would be }			73	...	18	...	9
e 58 or 80	"	...	16	...	8 parts								
						With 80 parts of tin, } this would give }			76·92	...	15·39	...	7·69
						With 58 parts of tin, } we would have }			70·73	...	19·51	...	9·76
f ...	3	"	4	"	22 parts	...	33·33	...	44·45	...	22·22		

A specimen of an alloy used for plumber-blocks by Maudslay, Sons, & Field, Westminster Road, Lambeth, London, analysed by Dr. Heeren, of Hannover, gave the following results: 71·10 of tin, 6·85 of antimony, and 22·05 of copper, which would correspond almost exactly with the simple proportions of 1 of antimony, 3 of copper, and 10 of tin. This alloy is distinguished from all the preceding ones in this, that the quantity of copper is not only greater than in either of the others, but exceeds that of the antimony. This large proportion of copper, although it increases the cost, contributes very materially to the hardness and toughness of the alloy.

The alloys of tin, antimony, and copper, are best prepared by melting the copper first, and then adding the antimony, together with about $\frac{1}{3}$ or $\frac{1}{4}$ of the tin, and having carefully stirred the mixture, adding the remainder of the tin. In making the alloy marked *f* above mentioned, the quantity of tin being too small to divide, might be added at once.—*Mittheilungen des Gewerbevereins für das Königreich Hannover*, 1853, p. 149; 150, through *Polytechnisches Centralblatt*, No. 20, October, 1853.

To render Sandstone and other Porous Materials impervious to Water.—The sandstone is first heated to a temperature of about 400° Fahr., and then plunged into coal tar, heated to about the same temperature, and allowed to remain in it for about eight hours. In this way a mass is obtained so solid, that it is scarcely possible to break it with a hammer. Bricks and tiles require only four hours steeping, at

a temperature of about 230° Fahr. (Acid cisterns and refrigerators of Yorkshire sandstone, and many other applications of that material, have been boiled in this way, in fact, since several years, in many of the chemical factories of Great Britain, and with the best results).—*Förster's Bauzeitung*, 1853, p. 35.

New Species of Printing of importance to the Lace and Sewed Muslin Trade.—Under the name of *nature's own printing*, Mr. Von Auer, of Vienna, has announced a peculiar method for obtaining impressions of the leaves of plants, &c. The process consists simply in taking two polished metal plates, one hard, the best substance being copper, and the other soft, as for example, a plate of lead, and laying the article to be copied between them, and passing the plates between the rollers of a press, such as lithographers use. By the great pressure excited, a beautifully sharp and faithful copy of the article is produced on the leaden plate, from which impressions can be obtained, or by electrotyping it, a still better plate may be obtained, which can be employed for printing thousands of copies. The dried leaves of plants can be copied in this way, and by using gutta percha gently heated, even moist plants will give impressions. The chief use of this new art will, however, be, to the reproduction of lace, &c., for if a piece of lace, or of worked muslin, be placed between the plates instead of leaves, a beautiful intaglio copy will be produced, from which printed patterns can be provided. Such plates might be at once employed to print designs upon the muslin sent out to be worked.

It is but just to remark, that a similar invention was made about twenty years ago by a Dane of Copenhagen, of the name of Peter Kyhl, who, having died before he perfected the art, the idea was lost sight of.

Chemical Researches on Dyeing, by M. Chevreul.—M. Chevreul has presented his ninth memoir to the Academy of Sciences, containing some of the curious and important results of the investigations which he has been carrying on for several years in his capacity of Director of Dyeing at the Gobelins, upon the physical and chemical laws which act in the dyeing of animal and vegetable tissues. The public are already familiar with his beautiful observations upon the harmony and simultaneous contrast of colours, subjects upon which we shall have many opportunities of speaking. The results in his late memoir are not less important, and although apparently of an exceedingly theoretical character, they are of the highest practical utility. It is much to be regretted that our dyers should remain ignorant of the scientific principles of their art, and yet there is perhaps no branch of trade which could derive so much immediate benefit from the progress of physical and chemical science. Any person who paid attention to the specimens of dyed and printed fabrics lately exhibited in Dublin, will at once admit how deplorably this ignorance was exhibited by most, if not all, of our manufacturers in these departments, and in none more so perhaps than in the poplins. The same observations apply in an equal degree to another and different branch of manufacture, stained glass.

M. Chevreul employs the term *capillary affinity* to designate the force which acts in fixing the colouring matter to the tissue with which they combine. The decolourizing action of charcoal upon liquids comes in part under this category, and indeed the first ideas of M. Chevreul were derived from some experiments which he made so early as 1809, upon the action of that substance upon certain bodies.

Capillary affinity affords so striking a contrast to the ordinary phenomena of chemical affinity, that one is naturally led to look upon this kind of force as quite distinct. Thus, for example, gravel, coarse sand, and artificial cements, perfectly freed from their soluble constituents, when placed in contact with lime water, are capable, by prolonged contact, of abstracting a certain portion of the lime from the water. The quantity of lime thus removed by the gravel and coarse sand of the River Seine, from lime water containing 1·37 of lime in 1000 parts of water was 0·17 after a contact of about 80 days, and 0·71 after 13 years. The separation of lime from water in this way by substances which have no apparent tendency to unite chemically with it, exhibits in a very striking manner the peculiar character of this variety of force.

These results naturally lead to the question of—In what manner does wool, silk, and cotton act, at the ordinary temperature, upon the aqueous solutions of chloride of sodium, chloride of mercury, sulphuric and hydrochloric acids, lime water,

solution of hydrate of barytes, nitrate of lead, and yellow prussiate of potash? The experiments made to solve the question led to results which may be classed under three categories, and which indeed might be deduced *a priori*—1st. *The solution experienced no change in the relative proportions of its immediate principles.* Thus cotton plunged into a solution of chloride of mercury absorbs the salt and the water in the same relative proportion in which they existed in the solution; and yet it retains a portion with such force, that when washed with water until no reaction was produced with nitrate of silver, its behaviour with colouring matters was quite different from that of pure cotton. 2nd. *The solution ceded more water to the solid immersed in it, than it did of the salt dissolved in it.* Cotton plunged into a solution of alum, absorbs a greater relative proportion of water than of alum; still after a number of repeated washings it retains sufficient alum to be weakly dyed in solutions of cochineal or of log-wood. 3rd. *The solution ceded more of the substance dissolved in it than of water, to the solid immersed in it.* Cotton placed in contact with lime or baryta water comes under this head; so do wool and silk, with reference to chloride of mercury. In all such experiments, regard must be had to the temperature of the solutions, the quantity of liquid employed, and the duration of the immersion; conditions which, it is needless to observe, would cause the result to vary. M. Chevreul is also of opinion, that in all the preceding cases cited, the whole of the absorbed soluble substances might be removed from the tissues by repeated washings.

The influence exercised by solid bodies upon certain solutions, shows that filters may exercise a particular chemical action upon the liquids which pass through them, a fact of considerable importance to the practical chemist and pharmacist.

The great quantity of water employed in dyeing in the vat requires, relatively, a much larger proportion of salts (mordants) than what fixes itself upon the goods. Thus, in the dyeing of wool, either as yarn or as woven fabrics, 16 parts of alum are employed in the dye beck, for every 100 parts of wool, although only 1.26 parts combine with the tissue, but in the present condition of dyeing this quantity is necessary, for if the affinity of the water for the alum was not satisfied, the tissue could not overcome that affinity, so as to combine with a sufficient quantity of the alum to produce a good dye. It is in this way that dyeing by the padding machine, as is now so frequently practised for Turkey reds, is so much cheaper than vat-dyeing. Nevertheless M. Chevreul was led from many trials to the conclusion, that dyeing in the vat may be done much more economically than we do at present.

M. Chevreul is of opinion that his experiments will materially assist in solving many physiological problems; because the moment it is proved that an organic tissue can react upon a solution, so as to appropriate one of its proximate principles, in a greater proportion than it does another, we can easily understand that analogous results would take place in the animal economy. Transudation of water may take place through a membrane, a cell, or a vessel, to the exclusion of the substance held in solution, and that, even where no glandulous apparatus exists. They also show how solutions which act upon the organs of taste, or even in the interior of an organ, may produce results at a certain degree of concentration, which disappear, however, or are not at all produced, when the relative proportion of water is more considerable.

These experiments also explain in a satisfactory manner why the roots of plants plunged into certain saline solutions, absorb proportionally more water than they do of the salts dissolved. And finally, it may be that dry tissues can concentrate aqueous solutions to such a degree as to make the salt crystallize by absorbing the water. Thus if a solution of chloride of sodium be introduced into one limb of an U-shaped tube, and some dry tissue, as for example, some tendons, into the other, it will be found after a couple of days, the tube being hermetically sealed, that a crystallization of the salt will take place above the level of the liquid.—*Comptes Rendus de l'Academie des Sciences*, No. 23. June, 1853.

On the Substances best adapted to prevent the Putrefaction of Animal Matter, and to absorb Ammonia, &c., by M. Payen.—M. Payen has presented to the French Academy, the results of a number of experiments on the absorption of ammonia, and on the action of certain substances in preventing the putrefaction of animal matter. These experiments are of considerable interest in connexion both with

agriculture and the sanitary condition of towns. The problem which M. Payen proposed to himself in these investigations, was to find some cheap substance, easily procurable, which would possess the property of preventing the evolution of those noxious effluvia which are given off from decaying animal substances, and at the same time form the basis of some active manures. Some time since M. Payen recommended the use of dried clay as litter, for absorbing the excrementitious matter of cattle, and experience has since confirmed his view of the value of this application. This result has led him to examine several other substances from the same point of view, as for example the action of clay, caustic lime, and carbonate of lime, in the form of marl, &c. Our space does not permit us to give in detail the numerical results of M. Payen's experiments, so we shall content ourselves with a summary of the conclusions to which he has arrived, as to the action of the three substances just mentioned upon animal matter, such for example, as urine:—

1. Well dried clay mixed with urine, has the property of preserving it to a great extent from decomposition, even when the mixture is exposed to the air in thin layers. But moist clay does not possess this property; on the contrary, the decomposition of the urine and the escape of the ammonia formed take place with great facility.

2. Caustic lime mixed with urine or other azotized matters prevent decomposition even more perfectly than dried clay.

3. Carbonate of lime or marl, on the contrary, hastens the decomposition of animal substances, by favouring the disengagement of ammoniacal compounds. A mixture of clay with the carbonate of lime weakens this decomposing action, hence rich clay marls are less active in this way than light shell marls.

The facts established by these experiments are directly applicable to many useful purposes. For example, the spontaneous putrefaction of urine may be prevented by impregnating the sides of the vessel containing it with lime. Sand also when mixed with about 5 or 6 per cent. of caustic lime, acts in a very satisfactory way, in preventing this species of decomposition; hence such a mixture might be advantageously employed for the absorption of liquids in stables, privies, slaughtering houses, &c. As the chief object of adding lime to animal substances is to prevent fermentation, which its presence does not arrest when once commenced, it is unnecessary to add, that once the putrefaction has commenced, an addition of lime would not only not be useful, but highly prejudicial, as it would decompose all the ready formed salts of ammonia with the evolution of free ammonia. These antiseptic properties of lime might be turned to great use in the evaporation of urine, which while fresh may be converted into a dried mass without decomposition, by the addition of a small quantity of it; or in the drying in the sun of large masses of animal offal. Many other applications will suggest themselves to our readers, as for example, the preservation of fish offal, &c.

M. Payen has also made several new experiments to determine the comparative value of wood, peat, and bone charcoals in preventing the decomposition of animal fluids. These charcoals, although preventing to a certain degree the decomposition of animal substances, do not possess that power in the same degree as dried clay or lime, when properly used; great as is the power of absorbing gases possessed by charcoal, it always allows a certain amount of decomposition to take place, and a similar quantity of ammoniacal compounds to escape. Wood charcoal is less effective than peat charcoal, and the latter less than animal charcoal. The addition of sulphate of iron (copperas) to peat charcoal, renders it capable of arresting the putrefaction of urine in the most perfect manner, although it may, as in the experiment of Payen, be exposed to the air for 35 days. This fact, which had been already well known, affords an easy means of preventing the evolution of noxious and fœtid gases arising from the accumulation of filth in crowded cities; and in no country in the world could such an application be more easily or more economically made than in Ireland, where peat charcoal could be had at a very trifling cost.—*Comptes Rendus de l'Academie.*

ART. V.—*Bulletin of Industrial Statistics.*

STATISTICS OF BELGIAN COMMERCE IN THE YEARS 1851 AND 1852.

Condition of the General Commerce of Belgium in 1851.—The foreign commerce of Belgium maintained in 1850 very nearly the same position which it had attained in 1849, a year of great commercial prosperity. In 1851 there was a slight diminution to the extent of about one per cent. The exportations in the latter year, exceeded the importations to the extent of about 13,000,000 of francs, or £520,000.

The total declared value of the importations and exportations of Belgium in 1851, was represented by the sum of 903,800,000 francs, or £36,152,000, which shews a diminution of 8,700,000 francs, or £348,000, compared with those of 1850; but if we compare the results of the commerce of 1851, with the mean results for the quinquennial period included between 1846 and 1850, we shall find that there was an augmentation of 138,300,000 francs, or £5,532,000, or 18 per cent. The following table represents in round numbers the trade of Belgium in the year 1851, and in the three quinquennial periods preceding that year:—

Official Values expressed in Millions of Francs.

Years.	Importations.		Exportations.		Importations and Exportations together.	
	General Commerce.	Special Commerce.	General Commerce.	Special Commerce.	General Commerce.	Special Commerce.
1836 to 1840, ...	226·8	194·7	174·6	141·8	401·4	336·5
1841 to 1845, ...	302·9	215·7	245·7	162·4	548·6	378·1
1846 to 1850, ...	391·7	229·0	375·8	212·0	765·5	441·0
1851, ...	445·1	241·1	458·7	253·8	903·8	494·9

This table proves that a rapid development of Belgian commerce has taken place since its separation from Holland; this development is particularly remarkable in the general commerce, which has more than doubled, in consequence of the facilities of transit afforded by the system of railroads.

According to the new estimation of the values of the imports and exports, or the *real values*, the general commerce of Belgium in 1851 was only 819,700,000 francs, or £32,788,800, that is, a difference of 84,100,000 francs, or £3,364,000, or 9 per cent. on the old valuation. This reduction principally affects the exportation, the old valuation of 459,000,000 of francs, being reduced to 401,000,000, being a reduction of 58,000,000, or 13 per cent., the reduction on the imports being only 6 per cent. This reduction does not effect the relative value of the preceding table, the numbers for the previous year having been also founded upon the declared value estimated upon the old system.

CLASSIFICATION OF THE SPECIAL COMMERCE OF BELGIUM FOR THE YEAR 1851.*

If we divide the special commerce of Belgium in 1851, into the following three classes of—Raw Materials, Articles of Food, and Manufactured Articles, and represent the whole Importation and Exportation, each by 100, the following will be the per-centage of each of the three classes of articles:—

	Importations.	Exportations.
Raw Materials, ...	43 per cent.	43 per cent.
Articles of Food, ...	40 " "	15 " "
Manufactured Articles, ...	17 " "	42 " "

We thus see, that the exportation of manufactured articles produced in Belgium, is more than double the importation of foreign manufactured articles consumed in the country.

* Under the term special commerce, is to be understood the importation of articles which went into consumption in Belgium, and the exportation of the products of the soil, and of the industry of the country. General commerce being the term applied to the whole trade, transit, and otherwise of the country.

SPECIAL COMMERCE OF BELGIUM IN 1852.

The documents containing the results of the general commerce of 1852 not having as yet come to hand, we are unable to draw any comparison between that year and 1851. The following table contains very full details of the special commerce for 1852, and in order to enable our readers to form a correct opinion of the present position of Belgium, we have added similar tables for 1850 and 1851.

Imports for Home Consumption in Belgium for the Years 1850, 1851, and 1852.

		Nature of Unit.	1850.	1851.	1852.
Animals,	{Cattle ... {Sheep & Lambs	Head ...	16,942	18,105	10,093
Coffee	...	Cwts. ...	29,799	32,795	39,744
Cotton, (Raw)	...	lbs. ...	326,532	344,219	408,235
Cotton Fabrics	...	...	15,925,043	17,636,566	26,712,060
Fish	{Her-rings, {Salted ... {Fresh, dried, red, &c.	{Tons (mea- surement)	511,634	542,421	511,230
		Tons ...	3,884	6,380	3,351
		Tons (msrmt.)	10,626.5	12,410.8	15,089
		Tons ...	596	1,095	1,114.5
Flax,	{Stock-fish ... {Fresh fish ... {Raw ... {Dressed ...	...	879.29	1,394.5	925.5
		...	620	692.7	673.4
		...	3,698.3	3,658.2	5,169.8
		lbs. ...	1,704	736	1,095
Grain of various kinds,	{Wheat ... {Rye ... {Barley, Bere, &c. {Oats ... {Buckwheat ... {Beans, Vetches, &c. {Flour and Bran, Colza, Rape, Linseed, and Hempseed	Tons, ...	31,097.3	44,400	90,110.6
		...	10,037.4	19,972.5	21,088
		...	23,836.7	21,250.3	23,628
		...	6,827.4	7,844.9	6,691.5
		...	78.3	1,296	869.6
		...	2,559.3	3,677	5,016.6
		...	1,873.5	1,892	1,587.4
Quarters	250,373	190,395	203,298		
Haberdashery	...	Value in Pounds Strlg.	{£75,354	71,391	73,217
Hides, (Green and Dried)	...	Cwts. ...	55,580.7	42,811	44,160.9
Modes, and Ready-made Clothes	...	Value in Pounds Strlg.	{£41,029.8	41,910.8	40,397.4
Muslin, Lace, (Cotton Net, &c.	{Cotton ... {Linen & Silk	...	£24,833.6	23,450.3	23,967.4
Plate Glass (Silvered and Unsilvered)	...	...	£8,210.8	9,740.9	9,853.7
Rice, of all kinds	...	Tons ...	£7,550.7	8,509.9	8,689.5
Potatoes	...	Bushels ...	12,111	9,287	17,282.8
Salt (unrefined)	...	Tons ...	514,153.6	844,632.8	784,883.6
Silken Fabrics	...	lbs. ...	31,640.7	36,969.5	42,016.7
Raw Colonial Sugar	...	Cwts. ...	180,488	167,800	173,745
Timber,	{Sawn ... {Unmanufactd.	Tons (mea- surement)	493,609.6	378,891.9	455,547.6
Tobacco,	{Manufactured ... {into Cigars	Cwts. ...	18,861	32,752	26,762
Wines	...	Gallons ...	24,624	24,333	32,001
Woollen and Worsted Fabrics	...	lbs. ...	79,989	90,881	113,198.6
	...	...	83,603	91,970	72,251
	...	...	2,725,148	2,414,756	2,286,644
	...	...	688,158	736,688	794,086

Exports of Belgian Produce and Manufactures in the Years 1850, 1851, and 1852.

			Nature of Unit.	1850.	1851.	1852.
Animals,	{ Horses	...	Number ...	15,752	16,549	16,870
	{ Cattle	...	" ...	8,928	8,217	8,339
	{ Pigs	...	" ...	81,900	77,630	81,270
Bark	...	...	Tons ...	11,530·8	13,550·5	12,020·6
Books	...	...	Cwts. ...	4,411	7,215·5	7,058·9
Coal	...	...	Tons ...	1,956,134	2,020,444	2,067,907
Cotton Fabrics	...	...	lbs. ...	2,782,246	2,796,149	3,695,127
Fire Arms	...	...	Value in Pounds Strlg.	£197,994·8	239,564	215,857
Flax	{ Raw	...	Tons ...	10,842·7	9,020·8	12,515
	{ Dressed	...	" ...	41·6	46	75·4
Glass,	{ Plate Glass, Silvered and Unsilvered	...	Value in Pounds Strlg.	£35,633	38,425	49,490
	{ Flint Glass (Crystal) Blown & Moulded	...	Cwts. ...	8,935	13,938·9	10,816
	{ Ditto, Cut or Engraved	...	" ...	15,665	13,905	16,176
	{ Window Glass	...	" ...	229,798·4	271,175	321,222·5
Grain,	{ Wheat	...	Tons ...	27,982·4	6,129·4	398·9
	{ Rye	...	" ...	184	2,637	11,160
	{ Barley	...	" ...	58	20·8	397·3
	{ Oats	...	" ...	35·8	19·4	963·5
	{ Buckwheat	...	" ...	3,249·4	1,722	2,161
	{ Beans, Vetches	...	" ...	787·6	20·4	674·5
	{ Flour and Bran	...	" ...	315·5	334·5	419
	{ Colza, Rape, Linseed and Hempseed	...	Bushels ...	62,775·7	50,659·8	67,412
Leather	...	...	Cwts. ...	5,980	7,516	9,628
Iron	{ Pig and Refined Iron	...	Tons ...	93,106	61,813·8	64,451·9
	{ Castings	...	" ...	534	754·9	657·3
	{ Wrought Iron	...	" ...	1,153·8	1,224·5	1,322·7
	{ Nails	...	" ...	9,220	9,061·3	8,760·8
Lace, Lawn, &c.	{ Cotton	...	Value in Pounds Strlg.	£56,680	66,041·4	88,127·4
	{ Silk and Linen	...	" ...	£38,395	50,355	64,855
Linen,	{ Yarn	...	lbs. ...	3,196,398	2,637,817	3,110,739
	{ Fabrics	...	" ...	4,368,958	3,331,541	3,949,132
Machinery (not inclusive of)	...	...	Tons ...	3,945·6	4,555·7	5,072·9
Cards	...	...	...	...	...	...
Potatoes	...	...	Bushels ...	811,802	198,274	202,279
Salt (Refined)	...	...	Tons ...	2,463·6	3,176·8	2,581·8
Sugar (Refined)	...	...	Cwts. ...	325,061	290,772	275,604
Tobacco, (manufactured into)	...	...	...	...	...	...
Cigars	...	...	lbs. ...	477,551	633,264	379,621
Tow	...	...	Cwts. ...	46·3	727·5	1,549·8
Woollen Fabrics,	{ Cloths, Cashmeres, &c.	...	lbs. ...	1,843,280	1,920,457	1,708,149
	{ Other than Cloth	...	" ...	183,621	130,860	146,692
Zinc	{ Raw	...	Tons ...	6,907	6,937·8	6,637·4
	{ Rolled	...	" ...	4,852	4,958	5,873·7

An examination of the previous table shews that in 1852, compared with 1851, there was an *augmentation* in the importation of the following articles—sawn timber, coffee, cotton, skins, and leather, corn, raw and dressed flax, rice, salt, raw sugar, unmanufactured tobacco, woollen fabrics, lace, muslin, &c. of cotton, linen, silk, and silken fabrics. On the other hand, there was a *diminution* on unsawn timber, linen yarn, clothes, cotton fabrics, and wine. There was an

augmentation in the exportation of the following articles—cattle, coal, leather, horses, tow, refined iron, works in wrought iron, linen yarn, corn, raw flax, machinery, cotton fabrics, woollen fabrics other than cloth, linen fabrics, lace, lawn, &c. of cotton, linen and silk, cut and engraved flint glass, and window glass, nails, and rolled zinc. There was a *diminution* in the exportation of the following articles—fire arms, castings in iron, woollen fabrics, flint glass (blown and moulded), and spelter (raw zinc). The exportation of raw flax was greater than in any preceding year, the augmentation in 1852, over 1851, being 3,494 tons. The augmentation in the export of coal in 1852, over that of 1851, amounted to 47,463 tons.

The linen manufacture of Belgium seems to be again recovering from the great depression under which it laboured in 1851, the augmentation in the exportation of yarn in 1852, over that of 1851, having amounted to 472,922lbs., and of linen fabrics, to 617,591lbs. In 1851 the linen manufactures of Belgium were losing ground in all the markets of the world without distinction, especially in France and in the Spanish Antilles. The hopes which were founded upon the manufacture of *russias*, *gantes*, *listados*, and the similar articles for the Cuba market were not realised. In 1849 the exportation to that island was 402,909 kilogrammes, which fell in 1850 to 135,584 kilogr., but rose in 1851 to 155,102, and finally fell again in 1852 to 34,349 kilogr. This great diminution in the exports to Cuba was more than compensated for by an increase in the exports to France, which rose from 519,307, in 1851, to 1,004,640 kilogrammes, in 1852. From the great exertion now made to develop this branch of industry in Belgium, by the introduction of spinning machinery and industrial schools, (*Ecoles d'Apprentissage*,) there can be no doubt that it will again become prosperous. One of the causes of the decay of this branch of trade in Belgium, was not introducing flax machinery, without which it would have been hopeless to attempt to compete with the Irish and English flax spinners. Some idea may be formed of the want of machinery in the linen manufacture of Belgium, by the fact that in 1849 the steam power engaged in flax spinning was only equal to 923 horse-power, or only 2 per cent. of the whole steam power of the country.

On the whole, therefore, as far as can be judged from the preceding tables, the special commerce of Belgium was in a very prosperous condition in 1852.

COAL MINES OF BELGIUM.

Belgium has 331,136 acres of coal, or 5 per cent. of the whole surface of the country. The following tables shew the rapid development of the coal mining industry since 1830:—

Mean quantity of Coal raised for each of the Quinquennial periods, from 1830 to 1850.

	Metrical tons.*		Metrical tons.
From 1831 to 1835, ...	1,575,000	From 1841 to 1845, ...	4,330,000
„ 1836 „ 1840, ...	3,390,000	„ 1846 „ 1850, ...	5,250,000
1851, ...			6,234,142 tons.

Mean quantity of Coal exported during the same period.

1st period, ...	...	734,000
2nd „ ...	...	749,000
3rd „ ...	...	1,208,000
4th „ ...	...	1,657,000
1851, ...	...	2,057,050
1852, ...	...	2,100,731

These tables shew that the increase in production from 1830 to 1850, was more than 100 per cent., and of exportation 125 per cent.

* A metrical ton is equal to 1,000 kilogrammes, and an English ton to 1,015.98 kilogrammes.

Table shewing the comparative condition of the Coal Mining Industry in the years 1838, 1846, and 1851.

	1838.	1846.	1851.
Annual production, ...	3,260,271 ...	5,037,402 ...	6,234,000 tons.
Number of workmen, ...	37,000 ...	45,448 ...	47,000
Annual quantity raised per man, ...	90 ...	111 ...	132 tons.
Annual exportation, ...	775,534 ...	1,355,833 ...	2,057,000 tons.
Value of exports, ...	11,633,000 ...	18,303,745 ...	31,000,000 francs.
Royalty, ...	212,000 ...	177,315 ...	236,828 francs.

Notwithstanding this prodigious increase, the condition of the workmen is said to have improved.

The price of coal has gradually fallen, as the following table shews:—

Mean Price of Coal in Belgium.

Years.	Price per ton.		Years.	Price per Ton.	
	Francs.	Centimes.		Francs.	Centimes.
1839, ...	13	—	1845 „ 1847, ...	9	40
1840, ...	11	80	1848, ...	8	50
1841, ...	10	55	1849, ...	7	50
1842 to 1844, ...	9	10	1850, ...	8	—

The average price of all kinds of coal in Belgium in 1850, expressed in our money, was 6 shillings and 6·76 pence per ton (British); the corresponding price in England at the same time, was estimated at 5 shillings and 7 pence; in France, the average price at the same time, was for the north about 24 shillings, (not inclusive of the actual coal districts,) and yet the freights from Mons, the centre of the largest of the Belgian coal-fields, is comparatively low; for example, the freight per ton from Mons to Paris, in September, 1851, was 6 shillings and 9·3 pence; to Rouen, 6s. 11d.; to Lille, 3s. 2·7d.; to Calais, 5s. 2d.; and to Dunkirk, 3s. 2·5d.

The total quantity of coke purchased for the working of the state railways in 1851, was 45,424,532 kilogrammes, at an average cost of 1 franc 69 centimes, per 100 kilogrammes, which would give as the average price of coke in Belgium, 13s. 10d. per ton (British). This is, of course, inclusive of cost of delivery, and consequently the coke used in the manufacture of iron would be somewhat cheaper.

INDIGENOUS SUGAR INDUSTRY.

Whilst the manufacture of refined foreign sugar has been in a most critical condition, the beet sugar industry prospered. In 1850 the quantity of this sugar produced was only estimated at 6,000,000 of kilogrammes, or nearly 6,000 tons, but in 1851 the production rose to from 11 to 12 millions of kilogrammes, or from 11,000 to 12,000 tons. And as the total consumption of sugar in Belgium is only about 12 millions of kilogrammes, or nearly 12,000 tons, it hence necessarily happened, that the foreign sugar was almost totally driven from the home markets. This fact is of considerable importance, as it shews that with a protection now scarcely equal to that enjoyed in 1852 by colonial sugar in Great Britain, the beet sugar manufacturers of Belgium found themselves so prosperous as to be able to nearly double their trade in one year! In France, where the manufacture has taken firm root, and where for the last two years the colonial sugar is actually protected against the beet, such an increase would not be astonishing, but happening in Belgium, where the manufacture is of comparatively recent introduction, the fact becomes of great importance.

CONDITION OF THE BELGIAN RAILWAYS.

Rolling Stock of the Belgian Railways.—In 1844 there were 146 locomotives on the railways belonging to the state, whose total power was equal to 7,955 horses; in 1849 the number was 165, representing 10,103 horse-power. Of this number only 42, that is, one less than in 1844, were of foreign manufacture. On the lines granted to private companies there were, in 1844, 3 locomotives, representing a total of 72 horse-power; and in 1849 there were 45, representing 2,704 horse-power, the whole of which were of native manufacture. In fact, we may consider that since 1844 the whole rolling stock of the Belgian railways, with a few exceptions, were manufactured in the national workshops.

The following table contains the results of the passenger and goods traffic on the Belgian railways, from the date of the introduction of the Railway system to 1852 :

Year.	Traffic.		Receipts from Passenger Traffic.	Receipts from Goods Traffic.	Total Receipts.
	Passengers.	Goods.*			
		<i>Metrical Tons.</i>	<i>Francs.</i>	<i>Francs.</i>	<i>Francs.</i>
1835,	421,439	...	269,000	...	269,000
1836,	871,307	...	826,000	...	826,000
1837,	1,384,577	...	1,384,000	33,000	1,417,000
1838,	2,238,303	4,200	1,891,000	207,000	3,098,000
1839,	1,952,731	49,808	3,586,000	664,000	4,250,000
1840,	2,199,319	102,154	4,040,000	1,295,000	5,335,000
1841,	2,639,744	165,718	4,111,000	2,115,000	6,226,000
1842,	2,724,104	194,185	4,676,000	2,786,000	7,462,000
1843,	3,085,349	368,107	5,183,000	3,549,000	9,032,000
1844,	3,381,529	571,189	6,167,000	5,063,000	11,230,000
1845,	3,455,618	701,605	6,395,000	6,010,000	12,403,000
1846,	3,675,031	767,028	6,962,000	6,095,000	13,657,000
1847,	3,746,213	1,040,906	6,943,000	7,842,000	14,785,000
1848,	3,660,729	972,147	5,916,000	5,523,000	11,439,000
1849,	3,934,306	1,065,792	6,298,000	6,498,000	12,796,000
1850,	4,188,614	1,272,075	7,128,000	7,725,000	14,853,000
1851,	4,355,766	1,282,800	8,042,000	9,268,000	17,310,000
1852,	4,451,304	1,490,284	8,095,000	10,545,000	18,640,000

An examination of the preceding table shows that the augmentation of traffic upon the Belgian railways from the year 1843, the period at which the principal lines were completed, was as follows:—

1. Passengers, ... from 3,085,349 to 4,451,304.
2. Goods, ... „ 368,107 tons to 1,490,284 tons.
3. Receipts, ... „ 9,031,519 francs to 18,639,738 francs.

That is to say, in ten years the general traffic of the Belgian railways increased in the following proportions:—1st, the passenger traffic to the extent of 44 per cent.; 2nd, the goods traffic by 305 per cent.; and the total receipts by 106 per cent. This extraordinary development must be very encouraging to the promoters of railways in Ireland, for there can be no doubt that when our system of lines is complete, the increase of traffic will be enormous.

It is worthy of remark that the traffic on the great trunk line of Belgium, from Antwerp to Cologne, is greater from Antwerp to the Rhine, both in weight and value, especially in the former, than the traffic from the Rhine to Antwerp. Large quantities of raw materials of great bulk and weight are sent from Antwerp to the Rhine, but the return trade from Germany consists in a great measure of manufactured articles of comparatively little bulk or weight, although of high value. On comparing the respective traffics of this railway for the years 1845 and 1852, it is found, taking every circumstance into account, that the trade from the Rhine to Antwerp has increased in a greater proportion than that from Antwerp to the Rhine; for while the latter has about doubled in weight, and only increased in value about one-fourth, the former has quintupled in weight and quadrupled in value. This fact is a striking proof of the rapid progress of the exportation of German manufactures—*Summarized from the Annales du Commerce Extérieur, No. 691, and Observations faites au Parlement Belge, par le Comité des houillères de Mons, 1852.*

[In a future number we shall give a notice of the general results of the commerce of 1852, and of some of the chief branches of industry, especially of the linen, woollen, and iron manufactures.]

* Inclusive of luggage, but not of carriages, horses, dogs, or specie.

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ART. I.—*On the Artificial Breeding of Fish.* By G. J. ALLMAN, M.D.,
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History of the Discovery.

THE grand central problem of economic science, that round which all others arrange themselves as accessory, or at least as secondary in importance, has for its immediate object the production of human food, so that the sources of supply may be proportioned to the demand. While this demand varies in accordance with sufficiently definite and determined laws—laws derived from the established principles of physical and physiological science—the supply on the other hand is not only inconstant but indefinite; subjected to influences, many of which are imperfectly or not at all understood, it becomes in the present state of our knowledge often impossible to bring its variations under such precise laws as may enable us to anticipate and provide for the result. Accordingly sudden and unexpected failures of large sources of human food are phenomena of frequent occurrence, and have left behind upon the page of history, characters too deep and terrible ever to be forgotten. It shows, however, little faith in science and in the present progressive aspect of knowledge, to imagine that our ignorance is here invincible; it is for us to draw from the past that instruction of which it is so full, and, whether as states or as individuals, there is scarcely a single direction in which the exercise of our powers is more peremptorily demanded than in the investigation of the natural causes of these mysterious perturbations of the social system, with the view of applying a remedy or preventing a recurrence.

There are few more valuable and important sources of food than the fisheries, whether those of the sea or of our rivers and lakes. Fully recognizing this importance, the governments of various countries have from time to time taken them under their special guidance, and have instituted laws for their protection, which, though frequently based upon sound prin-

ciples, are too often, in consequence of our very imperfect knowledge of the habits of fishes, founded upon deficient data, and upon the evidence of ignorant and often interested men, and have necessarily been so far inoperative for good, or even productive of actual evil.

Among the most important fresh-water fisheries of the world are the salmon fisheries of Great Britain and Ireland. The quantity of fish obtained from the salmon rivers of Ireland and Scotland has been enormous, and has given to these rivers a world-wide reputation; and it is therefore with no little alarm that the proprietors have of late years witnessed an increasing scarcity of fish, and a necessary diminution of the large revenues which they had formerly derived from the fisheries.*

But this deterioration has by no means been confined to the British and Irish salmon fisheries; it has also been observed to an alarming extent in some of the most valuable trout rivers of the Continent, and the ingenuity of men whose means of subsistence depended on the productiveness of these rivers, has been put upon the stretch, while the attention of their government has been actively directed to discovering the cause of the evil, and devising a remedy.

Unfortunately, this cause lies in great obscurity; it is true that in some rivers, at least, the diminution of fish may be traced to destructive modes of fishing, and when this is obvious the remedy is in the hands of government, and can at once be applied.† But it is no less true that in many cases—and these we fear are the most numerous—the cause lies far deeper, and can alone be sought for in some peculiarities of habits, or in other purely natural sources, whose investigation must necessarily be attended with immense difficulty, though we have no reason to despair of well-directed research ultimately solving the riddle.

Whatever may be the true cause of this mysterious deterioration of the river fisheries, remedies of one kind or another have from time to time been suggested, and among these there is one so ingenious, and altogether so peculiar, as to have excited a large amount of public curiosity, and to have drawn towards it among our Continental neighbours the marked attention of government. We allude to what is called the artificial breeding of fish, and it is to this singular suggestion for re-stocking with fish exhausted rivers, that the present paper is devoted.

* It is particularly gratifying, however, to witness in this country a marked tendency towards the return of the old productiveness of our rivers—a change which it is but just to attribute to the more general operation of the laws for the preservation of the fisheries. Until a very recent period these laws had not been enforced, and were in numerous instances openly violated; and it is a fact of much significance, that the improvement now showing itself in the Irish rivers is coincident with the more effective carrying out of the provisions of the law under the active administration of the commissioners. See the Report of the Commissioners of Fisheries for 1852.

† See an interesting note on the River Fisheries of South Devon, by James Redmond Barry, Esq., Inspecting Commissioner of Irish Fisheries, Report of the Commissioners of Fisheries for 1852. In this note the impoverished state of the beautiful rivers of South Devon is distinctly shown to be mainly traceable to the utter neglect of all laws for their protection.

The function of generation in the greater number of fishes is, as is now well known, performed in a very different manner from what takes place in the higher members of the animal kingdom. In most fishes the ovaries or essential organs of the female consist of two membranous sacs, situated in the abdomen, and destined to give origin to ova or eggs. During the breeding season these sacs acquire an enormous development; they are then loaded with ova, and are known by the name of *roe*. When the ova have acquired a certain size they escape from the ovary, and are then excluded from the body of the parent. The essential organs of the male almost exactly resemble in position and in external form those of the female; they undergo, in the same way, an enormous periodical development, which occurs at exactly the same time with the corresponding phenomenon in the female, and they are then known as the *milt*. Instead, however, of giving origin to ova, their proper product is a peculiar creamy fluid, intended for the fecundation of the ova produced in the ovaries of the female.

The contact of the spermatic fluid, or peculiar product of the milt, with the ova, is essential for the development of the embryo, but this contact takes place in by far the greater number of fishes after the ova have been excluded from the body of the female; when this exclusion has been effected, the male sheds a portion of the fecundating fluid in the neighbourhood, and this fluid mixing with the surrounding water, is thus conveyed to the ova, and immediately induces in them a new action which results in the development of an embryo.

When once the mode in which the ova received the fecundating influence of the male fluid was understood, it naturally suggested itself that the same process might be artificially imitated, and accordingly several successful attempts were soon made to fecundate the ova of a female fish by artificially bringing into contact with them the spermatic fluid developed in the milt of the male.

It is now about a century since a German naturalist, named Jacobi, instituted a series of well-devised and carefully conducted experiments, on the artificial fecundation of the ova of salmon and trout, and on the subsequent hatching of the fecundated ova, and the rearing of the young fish. The results of Jacobi's experiments were first made known by the Count de Goldstein, in a letter addressed, in 1758, to M. de Fourcroy, an ancestor of the celebrated philosopher, and were subsequently published in the *Hanover Journal* for 1763, and in the *Transactions of the Royal Academy of Berlin*, to which they were communicated by M. Gleditsch in 1764.

A French version of the letter of Goldstein was published, in 1773, in the *Traité des Pêches* of Duhamel de Monceau; and in the *Transactions of the Dublin Society* for 1799 is an English translation of Jacobi's Memoir, taken from the *Hanover Journal*. It would thus appear, that to the early labours of the Dublin Society is due the introduction into this country of a knowledge of the method of artificial fecundation originally practised in Hanover by Jacobi.

Though Jacobi himself gave to his discoveries a direct practical and commercial application, and though the British Government, in recognition of their importance, conferred at the time a pension on their author, they

appear, nevertheless, to have attracted little further attention, and the power of artificially fecundating and hatching the ova of fishes was for many years afterwards viewed rather as a curious scientific fact, than as one admitting of any important practical application.

At length, in 1836, Mr. John Shaw, of Drumlanrig, the manager of the Duke of Buccleuch's salmon fisheries, commenced a series of very important experiments on the artificial fecundation of the ova of the salmon, with the view of deciding some disputed points concerning the migration and growth of this fish.* The experiments of Mr. Shaw must be considered as the first step towards the revival of the practical element in Jacobi's researches, and this practical application was still further carried out by Mr. Boccius, of Hammersmith, who, in 1841, employed the proceeding of artificial fecundation, with a view of stocking with trout several rivers in various parts of England.

In the mean time, in a remote valley of the Vosges, a Department in the north-east of France, a poor peasant, Joseph Remy, was endeavouring to support himself and his family by the laborious occupation of a fisherman in some of the high tributaries of the Moselle, one of the most celebrated trout rivers in France. The rivulets of his native valley, however, enjoyed no exemption from the evil which had already been making itself felt in so many of the best fishing districts of the country. Endowed with great power of observation and with indomitable endurance, Remy set himself to work to devise some remedy for the increasing diminution of the fish, which constituted the sole source of his livelihood; and day after day, concealed amid the long reeds, which grew beside the stream, he would watch the manœuvres of the trout in the clear waters, while many a cold November night found him still at his post, acquiring a knowledge, which could not otherwise be obtained, of the habits of these fish, and accumulating facts which were one day to receive from him a most important practical application.

Unlearned in the writings of philosophers, and living in too remote a region for the discoveries of science to have reached him, we cannot wonder that a poor fisherman should be ignorant of what had already been achieved in the same field of observation, or that the most important of the facts which had revealed themselves to him were already well known to naturalists for more than a century. But however true all this may be, the merit of an original, accurate, and honest observer is not the less due to Joseph Remy, and it is certain that the application he made of his discovery has turned the attention of the French Government to a subject of vast importance in economic science, a subject which, at least in France, bids fair to become the origin of a new branch of industry.

But Remy perceived that his discovery admitted of a more extended application than his own unassisted resources would allow of, and he accordingly obtained the co-operation of his friend Gehin, a man occupying the same social position as himself. The united labours of the two friends were eminently successful; and Remy and Gehin soon raised many hun-

* Edinb. New Phil. Jour., vols. xxi. and xxiv.; also, Trans. Roy. Soc. Edinb., vol. xiv. (1840).

dreds of thousands of young trout, which they made use of in stocking the streams and rivers of their neighbourhood.

The fame of the two fishermen soon made its way to Paris, and their claims to the attention of government having been brought before the Academy of Sciences by M. Haxo, Physician at Epinal, in the Vosges, a commission, under the direction of M. Milne-Edwards, one of the most distinguished zoologists of our time, was in 1850 appointed by government to visit the scene of Remy and Gehin's labours, and report on the amount of merit which their proceedings might appear to possess.

The report drawn up on this occasion by M. Milne-Edwards, is a most judicious and valuable document. It is highly favourable to the two fishermen of the Vosges, whom he recommends to the special attention of the minister, and who have since, in consequence of the representations contained in the report, obtained appointments under Government. Of the value of the process of artificial fecundation, M. Milne-Edwards is deeply impressed. "It appears to me indubitable," says he "that within the space of a few years it will be possible not only to multiply salmon to a great extent in all the rivers where they are naturally found, but also to acclimatize these fine and valuable fish, and introduce them into many of our rivers which have been hitherto entirely destitute of them. For stocking our rivers with salmon and trout, as well as with many other kinds of fish, the process adopted by MM. Gehin and Remy seems to me to be the surest and the easiest."*

The report of M. Milne-Edwards had the effect of still further attracting the attention of government to this important question, and it was shortly after decided that a model establishment for the artificial breeding of fish should be founded at Huningen, on the canal which connects the Rhone with the Rhine. For this purpose a grant of 30,000 francs has been made by government, the care of the new establishment has been given to MM. Berthot and Detzem, the engineers of the canal, and M. Coste, a distinguished zoologist, and professor of comparative embryology in the College de France, has been appointed to preside over its organization. M. Coste was at the same time commissioned to undertake a scientific tour through various parts of France, especially along the Mediterranean shores, with the view of determining the places where the new mode of pisciculture could be most profitably practised; and in order that he might have every opportunity of studying various proceedings of importance in this great economic question, he was directed to proceed to Italy for the purpose of visiting the lagunes of the Adriatic, and particularly that of Commachio, where, from time immemorial, fisheries of a very remarkable kind and on a vast scale have been carried on.

Habits of the Salmon.

The great value of the salmon, and the importance which this fish holds in the fisheries of Great Britain and Ireland, have rendered it, more than any

* *Rapporte sur la Pisciculture adressé a M. le Ministre du Commerce. Annales des Sciences Naturelles. 1850.*

other species, the subject of the experiments which in this country have been tried with reference to artificial breeding. A few words therefore on the habits of the salmon will not be out of place before we proceed to describe the mode of operating adopted by the pisciculturist in his attempts to imitate the proceedings of nature in the multiplication of fish.

The true salmon (*Salmo salar*), the bull-trout (*S. erioz*), and the salmon trout or sea trout (*S. trutta*), differ from the other British and Irish species of the genus *Salmo*, by their habit of migrating from the fresh water to the sea, and back again to the fresh water, at definite periods of the year.

It is during the winter months that in this country the salmon deposits her spawn; the exact period, however, varies with local circumstances, in some rivers being much earlier than in others. The usual months are December, January, and February. The spawn is never deposited in the sea, and as the breeding season approaches the fish may be seen ascending towards the higher portions of the river. During their journeys up the river no ordinary obstacle can interrupt their progress. They shoot up rapids and ascend cataracts, springing from basin to basin in the rocks, and even cascades of from six to ten feet in height will frequently be cleared by them at a single leap. When arrived at the spawning ground the preparations for depositing the ova commence.

The process of spawning is thus described by Mr. Scrope, an accomplished angler and accurate and trustworthy observer:—"Salmon are led by instinct to select such places for depositing their spawn as are the least likely to be affected by the floods. These are the broad parts of the river, where the water runs swift and shallow, and has a free passage over an even bed. Here they either select an old spawning place, a sort of trough left in the channel, or they form a fresh one. The spawning bed is made by the female. Some have fancied that the elongation of the lower jaw in the male, which is sometimes in the form of a crook, is designed by nature to enable him to excavate the spawning trough. Certainly it is difficult to divine what may be the true use of this ugly excrescence; but observation has proved that this idea is a fallacy, and that the male never assists in making the spawning place; and indeed, if he did so, he could not possibly make use of the elongation in question for that purpose, which springs from the lower jaw, and bends inwards towards the throat. When the female first commences making her spawning bed, she generally comes after sunset, and goes off in the morning; she works up the gravel with her snout, her head pointing against the stream, and she arranges the position of the loose gravel with her tail. When this is done, the male makes his appearance in the evenings, according to the usage of the female; he then remains close by her on the side on which the water is deepest. When the female is in the act of emitting her ova, she turns upon her side, with her face to the male, who never moves. The female runs her snout into the gravel, and forces herself under it as much as she possibly can, when an attentive observer may see the red spawn coming from her. The male in his turn lets his milt go over the spawn; and this process goes on for some days, more or less, according to the size of the fish and

consequent quantity of eggs. During this time, trout and other fish will collect below to devour the spawn that floats down the river.”*

This account agrees in all essential points with those of the most accurate observers of the habits of the salmon in this country. The observations of Mr. Keiller, however, on the salmon of the river Save in Norway, as given in Lloyd's *Scandinavian Adventures*, are in some respects different. In that very interesting account,† it is stated that the salmon never makes a trough or depression in the bed of the river for the reception of her eggs; that the male, instead of remaining close beside her during the period of spawning, stations himself six or seven feet behind her, directly in her wake, and that as the eggs pass from her, they are carried down the stream, and impregnated by the secretion of the milt which is diffused through the water by the male fish, as the eggs float by him. During this process, hundreds of trout, sea-trout, and other fish are posted below ready to pounce upon the liberated spawn; while such eggs as escape the surrounding dangers, find their way into the crevices of rocks and under stones, and such other cavities as may afford them a secure retreat during the development of the embryo which is to follow. The observations of Mr. Keiller were made with every possible precaution to secure truthful results, and the differences between his account and those of such observers as have confined themselves to the British and Irish rivers, must be referred to real difference in the habits of the fish frequenting the different localities.

The spawning process continues with the same fish for several days in succession. The males may at this period be easily known by a peculiar growth of the lower jaw, whose point during the breeding season turns up, forming a kind of hook, which fits into a corresponding depression of the upper jaw. They are much less numerous than the females, and the fecundating fluid of a single male is sufficient to impregnate the ova of many females. When at last the female has got rid of all her ova, and the male of the secretion of his milt, the fish appear exhausted—they are emaciated, out of season, and unfit for food. They now, with the floods at the end of winter and commencement of spring, begin to descend the river, and ultimately reach the sea, when they speedily recover their health, and again enter the river either in spring or summer, when the ovaries are but little advanced and the fish in high condition, or else in autumn, when the mature state of the roe indicates the approach of the spawning season.

The fecundated ova remain in our rivers from 90 to 114 days, or perhaps even longer, before they are hatched, a difference of duration which appears to depend principally on a difference of temperature in the water, the process of development being more rapid in a high than in a low temperature.

When, at the end of the period of *fætation* or development of the embryo within the egg, the young fish becomes liberated from the membranes which had confined it, the remains of the yolk are still attached to it in

* Days and Nights of Salmon Fishing.

† *Scandinavian Adventures*, vol. i.

the form of a large bag, called the umbilical vesicle, which is appended to the abdomen of the little fish and communicates with its intestine. The contents of the umbilical vesicle serve as nourishment for the fish during this early period of its growth; they are accordingly gradually absorbed into the intestine, and ultimately all trace of the vesicle and its contents has disappeared.

We have already alluded to some experiments made by Mr. Shaw, of Drumlanrig, on the growth of the young salmon. These experiments are of great value, and by exploding certain errors into which naturalists and anglers had previously fallen, have done much to clear up the history of this fish. Mr. Shaw has ascertained that the period of foetation extends over

114	days	when	the	temperature	of	the	water	is	36°
101	...	...	...	...	...	...	...	...	43°
90	...	...	...	...	...	...	...	...	45°

He has found that the umbilical vesicle is absorbed at the end of 27 days after the escape of the embryo from the egg.* At the end of two months the young fish is one inch and a quarter long; at the end of four months, it measures two inches and a half; and at the end of six months, it has attained the length of three inches and three quarters.

During the first and second years the salmon grows slowly, and is marked by peculiar transverse dark bands; it is then, indeed, identical with the little fish called *parr*, which is now known not to be a distinct species, as was previously supposed, but the young salmon in its first and second years. The reproductive powers of the male are very early developed, and the male parr will effectually fecundate the ova of a female salmon; the female, however, does not appear capable of breeding till after the end of the third year.

At the end of the second year it loses the peculiar markings of the parr, acquires a silver-grey colour, and is then known as the smolt or salmon fry. In this condition it migrates for the first time to the sea, and after two or three months, returns to its native river as a grilse or gilse, having increased, on an average, about a pound in weight for every month it had remained in the salt water. At the end of the third year the female grilse breeds, and soon after migrates for the second time to the sea. It now grows rapidly, and at the end of a few months once more enters its native river as a perfect salmon. During all the remainder of its life, it makes an annual voyage to the sea, and again returns to the river, where it performs the great function of perpetuating its species.

It now remains to describe the process by which the operations of nature are attempted to be imitated artificially, with the view of increasing the quantity of food yielded by the waters for the subsistence of the human race.

The practice of artificial breeding may be divided into five distinct phases—namely, 1. *Exclusion*, or the removal from the parent fishes, of

* In salmon artificially hatched, a longer time would seem to elapse before the disappearance of the umbilical vesicle.

the male and female generative elements; 2. *Fecundation*, or the application of the product of the male to that of the female; 3. *Fixation*, or the process of development of the embryo in the egg; 4. *Extrication*, or the escape of the embryo from the ovum; and, 5. *Feeding*. We shall now mainly follow the directions given by M. Coste,* whose experience in this department of industrial science must give peculiar value to his suggestions.

Exclusion and Fecundation.

The fishes upon which we wish to operate should be taken, if possible, immediately off the spawning ground at the period when they are just about to deposit their spawn. The following table shows the principal periods of spawning, in these countries, of the more important British fresh-water fish. It must be borne in mind, however, that it is, in many cases, impossible to fix with certainty the exact periods, as these vary considerably with locality and temperature :—

Name of Fish.	Period of Spawning.
Salmon (<i>Salmo salar</i>)	From November to February.
Salmon-Trout (<i>Salmo trutta</i>).....	From October to January.
Common Trout (<i>Salmo fario</i>)	From October to January.
Great Lake Trout (<i>Salmo ferox</i>)	September.
Northern Charr (<i>Salmo umbla</i>)	November and December.
Smelt (<i>Osmerus eperlanus</i>).....	March and April.
Grayling (<i>Thymallus vulgaris</i>)	April and May.
Pike (<i>Esox lucius</i>)	March and April.
Carp (<i>Cyprinus carpio</i>)	May and June.
Barbel (<i>Barbus vulgaris</i>).....	May and June.
Tench (<i>Tinca vulgaris</i>).....	June.
Carp-Bream (<i>Abramis brama</i>)	May.
Chub (<i>Leuciscus cephalus</i>).....	April and May.
Perch (<i>Perca fluviatilis</i>).....	April and May.

If the fish cannot be immediately removed from the spawning beds, they should, a little before the period of spawning, be placed in a reservoir, where they may be preserved alive, and from which they may be easily taken as required. The shorter the time, however, they remain in the reservoir the better; for the health of the fish and the good condition of the spawn is very apt to suffer by confinement. The milt is much less liable to injury from this cause than the roe, and M. Millet has been in the habit of keeping the male fish in his reservoirs, tethered by a cord passed through the gills and mouth.†

A vessel of glass, porcelain, wood, or other suitable material, is now procured, and into this we pour one or two pints of clear river water. The bottom of the vessel should be flat, and not narrower than the mouth, otherwise the ova, for whose reception it is destined, may become massed together so closely as to escape the action of the fecundating fluid to be subsequently applied to them.

These preparations being completed, a female fish is captured, and her

* *Instructions Pratiques sur la Pisciculture.*

† *Comptes Rendus de l'Academie des Sciences.* Dec. 26, 1853.

ova pressed from her body into the receptacle just described. In this operation, if the fish be not too large, the operator seizes her by the head and thorax with his left hand, while his right hand, having the thumb applied to the abdomen of the fish and the other fingers to the sides and back, glides like a ring from before backwards, and gently presses the eggs towards the opening which is destined to give them exit (fig. 1).



Fig. 1.*

If the fish, however, be too large for a single operator to manage, he will require the aid of an assistant, who holds her by the head over the receptacle, either by passing his fingers within the gill covers, or by means of a cord run through the same place. When the struggles of the fish are very violent, a second assistant may be needed, who then grasps her firmly by the tail.

In the operations carried on at the fishery of the Messrs. Ashworth, at Outerard, in the County of Galway, the fish is held under the water during the exclusion of the ova. This comes nearer to the natural process, and is perhaps, after all, the better plan. A larger receptacle will of course be needed than that used by M. Coste. Those employed in the Outerard fishery are 3 feet in length, and 20 inches in width, and are filled with water to the depth of 2 feet.

This step in the process being completed, a male is immediately procured, and by a precisely similar proceeding the secretion of his milt is pressed out into the same vessel which contains the eggs of the female, till a sufficient quantity is expressed to give to the water the appearance of

* Method of exclusion of the spawn. After Coste.

whey, while at the same time the eggs are gently moved about with the hand, or with a fine long-haired brush, so as to mix the whole well together, and bring every portion of the spawn in contact with the fecundating fluid. After a rest of two or three minutes, fecundation is accomplished. An appreciable change has already begun to show itself, and the eggs have now become somewhat more opaque than at the moment of their exclusion, but they afterwards insensibly assume their transparency; while, at the same time, a small circular spot appears on the surface of the yolk. The eggs, with the water which surrounds them, are then transferred to the apparatus where they are to undergo the subsequent process of hatching.

In the proceeding now described, some precautionary rules should be observed. When the ova have arrived at full maturity in the ovaries of the fish, the most gentle pressure will effect their exclusion. When, therefore, they offer any resistance to the manipulations of the operator, it is a sure sign that they are not ready for fecundation; all attempts to force them from the body of the parent must then be given up, and the fish must be returned to the water, in order that time may bring the ova to a proper state of maturity. Precisely the same rule holds good with respect to the male fish; any resistance offered to the free expression of the cream-like fluid of the milt, being a sign that this secretion is immature, and will require further time before it is fit for the purposes of fecundation. It is also to be borne in mind that a single male is sufficient to impregnate the ova of many females.

Some very important experiments have recently been made by M. de Quatrefages on the vitality of the spermatozoa, or essential part of the seminal secretion, in fish.* From these experiments he concludes that, for each species of fish there is a fixed temperature which is most likely to insure successful fecundation. The facts which he thus arrives at are generalised in the following table:—

For fish which spawn in winter, as the salmon and trout, the proper temperature is from	...	...	...	...	43° to 46° Fahr.
For fish which spawn in early spring, as the pike	...	...	...	...	46° to 50° "
" late spring, as the perch	...	...	...	...	57° to 61° "
" summer, as the barbel	...	...	...	...	68° to 77° "

These temperatures should consequently be those of the water employed in the artificial fecundation of the ova.

M. de Quatrefages has also found that the spermatozoa, after they have been diffused in water, lose their vitality in a very short time. He finds that this time,

					Min.	Sec.
For the Pike is at latest	...	...	...	...	8	10
" Roach	...	...	...	...	3	10
" Carp	...	...	...	...	3	
" Perch	...	...	...	...	2	40
" Barbel	...	...	...	...	2	10

Similar results would, doubtless, be arrived at in the case of most other fish, and M. de Quatrefages justly concludes that the application of the

* Comptes Rendus de l'Academie des Sciences. Mai, 1853.

seminal fluid to the ova should take place immediately after its exclusion, and that the practice sometimes adopted, of receiving the product of the female in one vessel, and that of the male in another, and then mixing the two, is almost certain to prove a failure.

Care should be taken not to heap too many eggs together in the same receptacle, as many of them would then be sure to escape the action of the male fluid. It will be necessary, therefore, when a large quantity of spawn, even though it belong to a single fish, is operated on, to divide it among several receptacles, and fecundate each lot separately.

M. de Quatrefages* informs us that M. Millet, struck with the fact that some fish occupy many days in the process of spawning, was led to believe that this indicated different degrees of maturity in different parts of the same spawn, and that with the view of satisfying himself on this point, he divided the whole roe of a single fish into five parts, keeping each part separate, fecundating each with the same milt, and exposing all to precisely the same conditions. He found, as the result of his experiment, that in the two posterior fifths scarcely one-tenth of the eggs escaped fecundation, that in the next fifth two-thirds remained sterile, while in the two anterior fifths not a single egg was fecundated. This important experiment appears to have been made on the trout and pike. M. Millet's conclusions are fully acquiesced in by M. de Quatrefages, and their great importance in the practice of artificial fecundation must be evident to every one. It must, however, be borne in mind, that the conclusions of other observers are opposed to those of MM. Millet and de Quatrefages, and Mr. Keiller, in the work already quoted,† records a precisely similar experiment on the salmon of the Save, but with a very different result, for here, on dividing a roe into three portions, every segment was effectually fecundated, though he admitted that, in the anterior segment, a greater number of eggs proved sterile than in the others. This difference of results may depend on the difference of species in the fish made the subject of experiment, and further observations are here much needed.

When the operation of exclusion is completed, the parent fishes are to be set at liberty; they are not a bit the worse for the treatment they had undergone, and in the following year they will breed just as well as if their spawn had never been subjected to artificial exclusion.

Fetation and Extrication.

Immediately after the completion of the fecundating process, the ova, as we have just said, are to be transferred to the hatching apparatus. The apparatus for hatching used by Jacobi consisted of a long wooden box, with a grating at each end, and with a bed of gravel laid upon the bottom. The fecundated ova were distributed through the gravel, and the box then plunged in a running stream, so that the water flowing in by the grating at one end might, after passing through the gravel bed, escape by the opposite grating. The method adopted by the two fishermen of the Vosges

* Comptes Rendus de l'Academie des Sciences. Mai, 1853.

† Lloyd's Scandinavian Adventures, vol. i.

was nearly similar; but instead of the long wooden box of Jacobi, Remy and Gehin employed a drum-shaped case, made of zinc, and perforated all over with small holes. Both these plans, however, have their inconveniences, and appear better adapted for experiments on a small scale, than for any great industrial enterprise; and we shall therefore now confine ourselves to a description of the apparatus proposed by M. Coste, and which has served as a model for the great piscicultural establishment of Huningen.

The apparatus of M. Coste (fig. 2) is formed of a series of parallel troughs, or small artificial canals, arranged in steps one below the other (*a*), and surmounted by a common reservoir, from which the troughs are directly supplied with water. Each trough, when full, flows over through a spout into the trough below it, the spout being placed alternately at the opposite ends of each little canal, and a constant current is thus established, flowing through one canal in one direction, through the next below it in the opposite, and so on through the entire series. This apparatus may be constructed of any size, and is thus equally adapted for experiments on a small scale in the laboratory, and for the most extensive commercial enterprise. The reservoir which feeds the hatching canals may be itself supplied by a pipe and cock (*b*), or by a stream conducted to it from a neighbouring river.

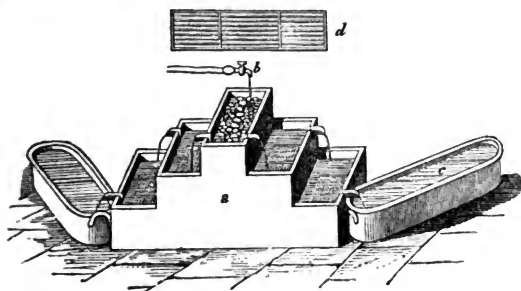


Fig. 2.*

The next important part of the hatching apparatus consists of shallow baskets, made of close wicker-work, or flat hurdles (fig. 2, *d*) of the same material. These are intended to support the ova during the progress of fecundation, and are preferred by M. Coste to the bed of gravel employed by Jacobi and by Remy and Gehin, as being far better adapted to facilitate that constant inspection of the ova which is so necessary to insure the success of the process.

The wicker hurdles or baskets are now deposited in the hatching canals, and so placed that they shall remain about one inch below the surface of

* Apparatus for fecundation. After Coste. *a*, hatching-canals; *b*, cock for regulating the supply of water; *c*, cisterns for young fish immediately after extrication; *d*, wicker stage for ova.

the water; and the apparatus being in full activity, with the necessary current established through all the canals, the fecundated eggs are placed upon their wicker stages, and abandoned to the influences by which the embryo becomes developed in their interior.

During the period that the ova remain in the hatching canals, the superintendent must from time to time examine them, in order to assure himself that they have not become attacked by parasitic vegetation, to which they are sometimes very liable. When the least appearance of a whitish downy coat, resembling a kind of mouldiness, shows itself upon the ova, it is a sure sign that they have fallen victims to this destructive byssoid growth, and when this occurs, we believe it is vain to attempt, as has been sometimes recommended, to free such ova from the parasite; the individuals thus attacked are killed, and any attempt to clear them will only disseminate the spores of the byssus and increase the mischief; there is nothing to be done but at once to remove the infected ova from the apparatus.

The accumulation of mud or other sediment over the eggs is also a casualty which must be guarded against. This, however, may in general be easily obviated by ordinary caution, and a proper regulation of the current of water directed over the ova. For preventing the accumulation of injurious sediment, and facilitating the removal of it when it occurs, the wicker stages possess obvious advantages.

Special care must also be taken not to allow the eggs to accumulate in a heap; they must be kept uniformly spread over the stages.

When all the necessary precautions are thus adopted, the progress of development goes on steadily in the interior of the egg. The length of time occupied by the several stages of this development varies greatly, not only with different species of fish, but with the same species, according to the temperature to which the eggs are exposed during the period of fœtation. It would be quite beside our purpose to enter into all the beautiful details of development which have been here traced by careful and prolonged observation, and which are among the most striking triumphs of modern microscopical research; we must, therefore, confine ourselves to some of the more obvious steps in this wonderful train of phenomena. The first decided traces of the embryo show themselves in the form of a narrow opaque line, lying just within the external membrane of the egg, and curved round the surface of the yolk, of which it occupies about one-quarter of the circumference. One end of this line becomes enlarged, and constitutes the embryonic condition of the future head; the opposite extremity is to become the tail. The rudiment of the vertebral column now shows itself running along the length of the little embryo; and it is not long before the eyes make their appearance, as two large dark spots, very easy to be detected, for they occupy very nearly two-thirds of the entire head. Soon after this the rudimental heart may be seen, under the microscope, regularly pulsating. At length the embryo fish begins to disengage itself at both ends from the yolk, and its movements within the external membrane of the egg become more and more lively.

The little embryo, though still enclosed within the egg, has now all the

essential organs of a vertebrate animal: it has a brain, vertebral column, organs of sense, intestine, pulsating heart, and circulating blood. Its movements within the egg are now very vivid, and it soon bursts the external membranes of the ovum, and escapes into the surrounding water. It is still, however, destined to undergo much further development before it acquires the definite characters of its species. As already mentioned, the remains of the yolk continue attached to it, in the form of a large bladder, the umbilical vesicle, and supply it with the nourishment necessary during this early stage of its existence. The umbilical vesicle, however, is gradually absorbed, and the little fish, assuming more and more of its perfect form, is ultimately in a condition to forage for itself among the various sources of food with which the surrounding waters furnish it.

When the young fishes escape from the egg, they may be removed from the hatching canals to a larger cistern (fig. 2, *c*), where they are to undergo further development. This cistern should have a gentle stream of fresh water constantly flowing through it. The newly-hatched salmon are at first very inactive, being incumbered by an enormous umbilical vesicle, and in this condition, in their native streams, they become by thousands the prey of various kinds of voracious fish.

Feeding.

A most important question in the rearing of the young fish now presents itself for consideration. Up to this time the embryo merely underwent a passive development in the interior of the egg, and only required for this development a constant supply of fresh aerated water; but the little animals have now entered on a more active state of existence, and the question immediately occurs—How are the young fish to be fed?

This question is easily answered, so far as concerns the period during which the umbilical vesicle continues visible, for as long as any portion of the contents of this body remains unabsorbed, the little animal will absolutely refuse all other nourishment. We must patiently wait, therefore, for the disappearance of the vesicle before we attempt to offer any food. When this body, however, has once disappeared, an occurrence which, in the salmon in a state of confinement, generally takes place at the end of six weeks, we know that the time has come when we must supply the young fish with food. For this purpose, nutritious substances of various kinds have been used. A paste made of raw meat or fish pounded into a pulp, is greedily devoured, and the little animals are found to thrive under this treatment. M. Coste, however, gives the decided preference to the muscular flesh of beef, boiled and beaten into a paste. The particles of this alimentary paste easily detach themselves from one another in the water, and are sufficiently minute to be swallowed by the fish. M. Coste has, by means of this preparation, raised in his laboratory in the College de France, no less than 2,000 young salmon at the same time, in a space only 22 inches long, 6 wide and 3 deep.

Besides these different kinds of artificial food, M. Coste highly extols the practice of feeding the young salmon with the fry of other fish. The eggs of various kinds of fish of little value are artificially fecundated, and

placed either in a separate receptacle or in the same reservoirs with the salmon; in due course the eggs are hatched, and the fry which escape from them are sufficiently small to be easily mastered by the young salmon.

Young tadpoles have been employed for the same purpose by the two fishermen of the Vosges, who obtain them in sufficient quantities by throwing frog-spawn into the reservoirs containing the fish; with M. Coste, however, this method has not succeeded; neither his little salmon nor young trout could ever be induced to feast on the tadpoles, even when of the smallest size, or on the gelatinous envelope of the spawn.

Different species of minute fresh-water crustacea, such as those belonging to the genera *Cypris* and *Cyclops*, are also recommended by M. Coste; but it is obvious that, though these often exist in countless multitudes in stagnant water, the difficulty of procuring a constant supply must at once decide against this mode of alimentation as quite inapplicable in practice.

During all this period great care must be taken to prevent the accumulation of dead animal matter in the reservoir, for this would soon frustrate all our labour, by putrefying, and thus proving fatal to the young fish.

Up to this time a very small space will be sufficient for the rearing of many thousands of fish; but, under proper management, they will soon increase so much in size as to require to be distributed in more capacious reservoirs.

It is not easy to assign the exact age when the young fish may be permitted to escape into the waters which are to become their permanent residence. It is certainly a mistake to prolong their stay more than is absolutely necessary in our artificial reservoirs; and we think it is the best practice, unless it be the object of the pisciculturist to keep a stock of fry on hand for the purpose of satisfying a demand, to set the young salmon free as soon as it has attained the age of six months at most.

If, however, we should be desirous of retaining them longer, the food with which we supply them may be of a coarser kind than that to which, during an earlier period of their lives, we were obliged to confine ourselves. For salmon of one year old, M. Coste enumerates, as suitable food, tadpoles, fry of various fish, and especially of minnows, aquatic mollusca, and small fresh-water crustacea; while fishes somewhat older will easily accommodate themselves to the debris of the kitchen, and to all kinds of flesh of domestic animals.

We have now given the result of the experience of some of the best practical pisciculturists on the question of feeding, but it must nevertheless be admitted that this part of the subject is as yet very imperfectly understood, and we believe that many experiments and much careful observation will still be needed before thoroughly satisfactory results can be arrived at. Indeed, M. Millet, whose opinion upon this subject is of great value, is opposed to any attempt at feeding, and believes it preferable to allow the young fish to escape a few days after the disappearance of the umbilical vesicle.*

* *Comptes Rendus de l'Academie des Sciences.* Dec. 1853.

Mode of Transport.

Intimately connected with the present subject, is another of much importance in this department of economic inquiry—namely, the best mode of conveying living fish or their ova to a distance, with the view of stocking waters previously destitute of them.

Great facility is here afforded by the process of artificial fecundation. The transporting of adult fish in a living state is a matter of so much difficulty as to be in most cases quite impracticable; but, on the other hand, the very young fry, and especially the fecundated ova, may be conveyed to almost any distance with the greatest ease.

For the transport of the fecundated ova, Remy and Gehin employ a perforated tin box, similar to those they use for the purpose of hatching. On the bottom of this box they form a bed of moist sand, and on the surface of the sand they place a layer of pebbles about the size of dice. In the intervals of the pebbles the ova are deposited, and then, above these, another layer of pebbles, with ova similarly arranged, and so on, till the box is full.

M. Coste objects to this mode of proceeding, as rendering the ova liable to injury from any violent concussion during the journey, and as exposing them to desiccation from excessive evaporation. He prefers a round or oblong box, made of thin wood, such as those frequently used for holding dried fruit. On the bottom of this he places a layer of sand, well moistened, and over the sand a layer of eggs, taking care not to let the eggs touch one another; then another layer of sand, with another layer of eggs; and thus he continues till the box is entirely filled, when he applies the cover sufficiently tight to prevent all chance of injurious concussion. The box should not be more than eight or ten inches long and four deep, otherwise the weight of the sand might prove destructive to the eggs. With an arrangement of this kind, M. Coste has preserved the fecundated eggs of salmon and trout, without injury, for nearly two months in a cold room. When about to remove the eggs from the sand, the entire box should be first plunged in water, to allow the eggs to become thoroughly wetted before their exposure. Of course, the length of time during which it is possible to preserve the eggs in this manner will depend upon the length of the period of *fecundation*. In salmon and trout this period is long, and the fecundated eggs may be kept in a fit state for 45 or 50 days at least, or when the temperature is low, even to upwards of 100.

M. Coste also speaks highly of the use of aquatic plants as a substitute for the sand in his transport boxes; he places the eggs in the boxes, with alternate layers of these plants, in a moist state, and covers all close, to retain the moisture. He does not state what particular aquatic plants he has been in the habit of using for this purpose.

We believe, however, that there is no mode of transport which can be compared to that of packing the ova in *sphagnum* or bog moss. The boxes may be constructed of wood or tin, and may be much larger than those employed by M. Coste. The *sphagnum* should be made perfectly moist, and it and the ova should be deposited in loose alternate layers

till the box is full. The large cellular tissue of the sphagnum possesses great power of retaining moisture, and the innumerable interstices included among its leaves and stems entangle so large a quantity of air as to insure the constant aëration of this moisture—a most important condition for the safety of the ova—while the peculiar elasticity of the vegetable will prevent all danger from concussion during the carriage. In Ireland and Scotland the sphagnum may be obtained in unlimited quantities on all our moist bogs; after being gathered, it should be dried and stored for preservation, and again moistened before being used; or if it could be immediately procured for use in a fresh state, it would perhaps be still better.

The particular stage of the period of fœtation during which the ova are to be transported is not a matter of indifference; for if they be disturbed shortly after fecundation, much risk of killing them will be incurred, and the safest rule in practice is to wait for the appearance of the two black spots which indicate the development of the eyes, and which are a sure sign that the ova may be removed without danger.

The transport of the young fish is a much more difficult thing than that of the ova, and the difficulty increases with the age of the fish. They are to be conveyed in vessels of water, and the water must be constantly changed during the journey. Such as are just hatched, however, may be carried in a comparatively small vessel, and will need a much less frequent change of water; while those which have lost the umbilical vesicle have the respiratory functions increased in intensity, and will require a much larger space and more frequent supply of aërated water. On the whole, the transport of the fecundated ova should almost always be preferred, when practicable, to that of the living fish.

Hybridization.

The possibility of obtaining hybrids or mules by artificially fecundating the ova of one species with the seminal fluid of another, has not been lost sight of by the pisciculturist, and in many cases the experiments in this direction have been attended with complete success. Crosses have been thus obtained between the salmon and the trout; but it seems that the same limits exist here as among other animals, and that, unless the species belong to the same genus, a productive union cannot be effected. Our knowledge, however, upon this subject is still very defective, and much may yet be expected from systematic and carefully conducted experiments.

General Remarks.

We have now given, in as much detail as our necessary limits would allow, an exposition of one of our economic resources, whose importance has only just been recognised, but which has already attracted to it a large share of public attention. We have examined the question in its essentially practical bearing, and have referred to the discoveries of the physiologist and of the scientific naturalist only so far as a knowledge of these discoveries are necessary for the complete elucidation of their practical application. It will now be asked—What are we to expect from this new branch of industry? Are we to look forward to any vast increase in the

productiveness of certain sources of human food? Are we, as has been forcibly expressed by an able French writer on this subject,—are we to expect to be able in future to sow the waters with fish as the husbandman sows the land with corn? *

Like almost every subject, which, possessing in itself an element of real value, has only just had public attention directed to it, the present question is liable to over-estimation; and as exaggerated anticipations are almost sure to bring their object ultimately into a disrepute, from which its true merits should have preserved it, there is need, in the present instance, of more than ordinary circumspection in order to separate the real from the fictitious value.

It may at first sight appear strange that any artificial process could succeed in increasing the effectiveness of the great law by which Nature provides for the multiplication of the species; but let us endeavour to see whether, by the process now described, we are not placed in possession of a means of obviating various accidents which naturally interfere with the productiveness of fish. In the first place, it is almost certain that by artificial fecundation we secure the impregnation of a large number of eggs which in a state of nature escape the influence of the male fluid. But besides this, the rivers in which the salmon deposit their spawn are liable to floods, which detach millions of ova from the spawning beds, and carry them away to regions unfavourable for their development; while a too dry season may, on the other hand, leave these beds without sufficient water, and thus equally expose the ova to destruction. But perhaps the most obvious advantage derivable from the artificial process lies in the fact, that we are, by its means, able to protect the ova and young fry from their natural enemies. The greater number of fish are predacious in their habits; and we have already seen that, while the parent salmon is in the act of depositing her ova, hundreds of voracious fish are posted in her neighbourhood ready to pounce on them and devour them. The newly-hatched fry, too, encumbered by their enormous umbilical vesicle, fall an easy prey to their enemies. All these casualties, which must result in the destruction of incalculable numbers in their native waters, are entirely obviated by the artificial method.

It may be now considered as an established fact, that, by the new method of pisciculture, many millions of young fish can be raised in a short time, with little trouble, and at a small cost. But when once we are in possession of this store of fry, the question next occurs—What are we to do with it? How are we to apply it so as to increase the quantity of fish available for human food?

Confining ourselves to the fresh-water fisheries, to which, indeed, the present article has been exclusively directed, there is one department of these fisheries which prominently presents itself in its relations to this new branch of industry. We allude to our salmon rivers. There are two classes of rivers of importance to the present question: 1. Those which, apparently possessing all the necessary conditions for the abode of the

* De Quatrefages.

salmon, are yet never visited by these fish; and 2. Such naturally good salmon rivers as, from some obscure cause not removable by the existing laws, have seriously decreased in productiveness.

Now as to the first class, there is not the least doubt that to the stocking of such rivers, the system of artificial breeding may be applied with every prospect of success, and such has actually been done in similar cases by the French.

The advantages of artificial breeding, when applied to the second class of rivers, is not quite so obvious.

We know that, at the end of its second year, the young salmon migrates to the sea, under the name of smolt or salmon fry; and if we could be sure of the return into their native river of all the smolt which thus migrated, the difficulties with which we have to grapple would be comparatively slight, for then it would be obvious that, by turning into the deteriorated river some thousands of young fish, we would, allowing of course for casualties, permanently increase the stock in the river by exactly so many as we have added. As it is, however, we know that but a small proportion of the fry which are annually produced in these rivers ever return to them after having once migrated to the sea. Of what becomes of them there we as yet know nothing; but it is, at all events, certain that something more is necessary than merely turning into the river our artificially-bred fry.

But may not some means be devised of securing the return of fish after their first migration to the sea? It must be admitted that here great difficulties exist, but yet we cannot think them absolutely insurmountable. In many parts of the coasts of Great Britain and Ireland, but perhaps nowhere so strikingly as on the west and south coasts of the latter, are deep and narrow inlets of the sea, having large streams of fresh water flowing into them from the land. Now, these combine all the conditions necessary in salmon-life, and as some of them might be enclosed at a small cost, there seems no reason whatever why they may not be converted into vast fish-parks, and by means of artificial fecundation kept permanently stocked with salmon and other fish of similar habits.

But the difficulty which exists in the case of such fish as require to spend a portion of their lives in the sea, vanishes in those whose whole existence is passed in the fresh waters, and it is to these that we find the energies of the French pisciculturists mainly directed. In France the production of trout by artificial fecundation has taken place on a large scale, and numerous rivers, from which these fish had been rapidly disappearing, have been successfully replenished. To this work the two fishermen of the Vosges have been actively applying themselves; in a single river—the Moselette, one of the tributaries of the Moselle—they have set free about 50,000 young trout; and Gehin, one of the two fishermen, has, by the command of the French Government, undertaken the stocking of the rivers in several of the Departments. His labours have been chiefly directed to Grenoble, and to different places in the Department of Isère, and have been followed by the most satisfactory results. He has, moreover, introduced the charr into the waters of those countries, and he has stocked one of the

French lakes with the magnificent species of trout peculiar to the Lake of Geneva.*

A special commission having recently reported favourably on the experiments of M. Millet, with reference to artificial fecundation, the "Director General of Waters and Forests," at the end of the report, applied to the Minister for leave to organise a system for the replenishing of all the rivers under his administration. The following statement by M. de Quatrefages will convey some idea of the importance of this enterprise. The rivers for which the demand was made have a total extent of 7,790 kilomètres.† In consequence of the destruction of the fish, the rent has fallen so low, that the revenue of these 1,500 leagues of river is only 521,000 francs, while, by the restoration of their fisheries to the condition enjoyed by properly preserved canals and rivers, this revenue would, at the lowest calculation, amount to five millions of francs at least.‡

For the introduction of various kinds of fresh water fish into quarters where they had not previously existed, the mode of artificial fecundation affords great facility, and by the transport of the fecundated ova, or of the very young fry, we may indefinitely extend the distribution of many valuable species. Thus, the smelt is a fish whose habits closely resemble those of the salmon, and there seems no reason whatever why this fish, so much esteemed for its delicacy and so rare in Ireland, may not be introduced into numerous rivers of this country, which seem just as well fitted for its residence as those of other countries where it abounds. The carp was itself originally introduced into England from the Continent, probably in the 15th century, and though now very abundant as an English pond fish, is by no means of such general occurrence in Ireland as it deserves; yet innumerable pieces of water in this country, at present entirely useless, are quite adapted for its abode, and by being stocked with carp, might be made to afford a constant supply of wholesome and nutritious food, and become like the carp-ponds on the Continent, a source of considerable profit to the proprietors. The silurus is a fish also abundant in many of the fresh waters of the Continent; it grows to a great size, attaining sometimes a weight of from seventy to eighty pounds; the flesh is nutritious, and though fat and somewhat luscious, is much esteemed in many places; now there appears to be no obstacle to its introduction into Great Britain and Ireland, where it would doubtless become a valuable addition to the supply of food afforded by our fresh waters.

M. Coste, with the view of determining all the conditions necessary for the rearing of eels in artificial reservoirs, has recently studied the habits of these fish with great care.§ During the months of March and April the eel fry may be seen, in countless millions, running up the rivers from the sea, and may be then easily captured in almost unlimited quantities. The eel admits of transport over land with a facility which is rare among fishes, and panniers full of fry may, by a little precaution, be carried in a

* Haxo Fecondation Artificielle, p. 62.

† A kilomètre is equal to about 1093 yards and a-half.

‡ De Quatrefages in *Comptes Rendus*. Mai, 1858.

§ Instructions pratiques. Rapport sur la Pisciculture, p. 84, &c.

living state to great distances from their native rivers, and deposited in reservoirs prepared for their reception. M. Coste feeds the eels in these reservoirs with refuse flesh of various animals, and has found them, under this treatment, to increase rapidly in size, and become a most valuable source of profit. The proceeding of artificial fecundation is in this case dispensed with; the eel breeds exclusively in the sea, and it is by attending to the instinct which obliges the newly-hatched fish to migrate in innumerable swarms into the fresh water, and by availing ourselves of the peculiar organization which enables it to retain its vitality in long journeys over land, that this important branch of pisciculture is proposed to be carried out.

With reference to this subject, M. Coste draws special attention to the great eel preserves of the Lagune of Commachio,—a vast natural reservoir communicating with the Adriatic, filled with different kinds of fish, and yielding, in eels alone, a produce of from 2,000,000 to 2,500,000 pounds weight every year, giving in round numbers an annual revenue of about £20,000.

The application of the system of artificial fecundation to marine fish offers a vast and most important field to the labours of the experimentalist; and though there can scarcely be a doubt that in the value of its results it will ultimately surpass the fresh-water process, yet, up to the present time, scarcely anything has been accomplished in it. The immense difficulty of acquiring a satisfactory knowledge of the habits of creatures dwelling continuously in the sea, has been a serious obstacle in the way of the pisciculturist turning his efforts in this direction; and yet we feel certain that, from scientific investigations carefully conducted, a vast deal of most valuable information may be expected—information which will instantly pass from the domain of science into that of industry. The French, who in the utilization of scientific truths almost always take the lead, have already had their attention directed to this subject, and M. Coste has just presented to the Academy of Sciences a memoir, in which he points out the importance of converting the great salt water lagunes of the southern shores of France into reservoirs for the breeding of marine fish.

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ART. II.—*The Mines of Ireland.* No. I. By J. BEETE JUKES, A.M. F.R.S., M.R.I.A., Director of the Geological Survey of Ireland, and President of the Geological Society of Dublin.

THE natural resources of a country may be roughly classified as those of production and those of transport and communication; of the latter it is sufficiently obvious that Ireland possesses an abundance. Those of production may be divided into those growing, or that can be made to grow, on its surface, and those which exist beneath the surface. The latter again may be subdivided into two branches, according to the means used for obtaining them, namely, quarrying and mining; including under the term quarrying, the getting of sand, gravel, and clay, as well as stone, and all other substances which can be dug in an open excavation; and under the term mining, such operations as require the sinking of shafts, and the driving of levels and galleries.

In the present series of papers we propose to describe some of the mining resources of Ireland, communicating from time to time all such pieces of information as may be acquired by us. It is as well to say at the outset, that the mining resources of Ireland, though respectable, are not very large. As an item in the national productiveness, they are of importance, but they can never be such as to raise her into a great mining country. The very fact, however, of the comparative scantiness of our mining wealth makes it all the more necessary that it shall be wisely administered. A very rich mine can afford to disregard the minutiae of

economical management; but in a poor one it is often reduced entirely to a question of skilful management, whether there shall be a profit left upon the operations or not. What is true of one mine, is true of the assemblage of mines in any country.

This question of profit reminds us of a point in the morale and the political economy of the subject, which it may be useful to say a word upon. We have often heard men, and even men of education, speak with regard to mining and other companies, as if it mattered little for the country whether the enterprises were successful or not, so that "*the money was expended in the country.*" Now there cannot be a greater fallacy than this. It is not the expenditure of capital that enriches a country, but the creation and accumulation of it. The expenditure of capital, unless with a profitable result, is in all cases *an injury to the country*, the depth of the injury being proportioned to the loss. The loss is so much absolute waste, differing but little, or not at all, from that caused by a fire or a storm. It is so much destruction of property. For a similar reason, a miser or holder of capital, like a holder of corn in a famine, is often a public benefactor, although he may not be aware of it. The grand test of mining, then, as of all other commercial enterprises, to the philanthropist as well as to the economist, is, "did it pay?"

With these preliminary observations, we would commence our notice of the mines of Ireland by a glance at those of Wicklow and Wexford, being guided in our examination by a little work just issued from the "Museum of Practical Geology and the Geological Survey." This is entitled, "Records of the School of Mines, and of Science applied to the Arts," Vol. I., Part 3, on the Mines of Wicklow and Wexford, by Warrington W. Smyth, M.A, Mining Geologist to the Geological Survey of Great Britain and Ireland.

Part 1 of this volume consisted of the introductory lectures delivered by the professors at the school in London. Part 2 was on the geology of the south Staffordshire coal field. And we are much gratified to find that Ireland has likewise received an illustration of some part of her structure in the first volume of these Records.

Mr. Smyth divides his subject into three parts, as follows:—

"The natural division of the county of Wicklow into two parts,—an elevated mountain tract of granite on the west, and a region mostly composed of clay-slate on the east,—coupled with the distinct character of the metalliferous deposits respectively occurring in these portions, lead to the consideration of our subject under the following heads, 1st, the lodes or mineral veins in the granite; 2dly, the ore deposits in the clay-slate; and 3dly, the gold and other minerals which have been met with in the drift or superficial detritus."

There is a characteristic of the two first-mentioned groups of lodes, which we do not think Mr. Smyth anywhere distinctly states, but which may yet be not without its significance, and is at all events worthy of being noted. This is, that the mineral veins on the flanks of the granite, while not entirely devoid of copper, principally contain lead ores, and are all worked as lead mines, while those in the slate district are all worked either as copper mines or as sulphur, containing copper, although lead is

likewise to be found in small quantities in some places. Mr. Smyth first of all gives a few general observations on the mineralogical and geological phenomena he has observed in the mineral veins of the two counties, and he then takes each mining district, and briefly describes the position, direction, and contents of the lodes, and lastly, the works that have been carried on in them, with occasional practical observations as to the method of working, and statistical details as to their results. We shall confine ourselves in our extracts and observations principally to the two latter points.

The two vallies called Glendasane and Glendalough, which unite at the Seven Churches, form the first district examined. Here the *Fox Rock*, the *Moll Doyle*, and the *Hero* lodes have only been partially worked, the indications not being of a very promising character. The *Ruplagh* lode has been worked in three mines, all now abandoned, two in consequence of the ore dwindling away, and one, because, "in 1844, the dry summer so reduced the water of Lough Nahanagan, which supplies the motive power to the machinery, that the pumps could not be kept in action, and the excavations were drowned; whilst it is inferred from the destructible nature of the granite, that all is now in so ruinous a state, as to be dangerous to re-open." This defect of water from Lough Nahanagan, Mr. Smyth thinks, might by suitable arrangements have been avoided. The *Luganure* lode is the one on which the present works are being carried on with very considerable success, as shewn by the following:—

"During the last five years roads have been constructed up the mountain, railways carried underground, by which a mule can convey three waggons at a time, a stamps of 16 heads has been erected, and the whole brought into so flourishing a state, that about 200 people are now employed under and above ground. The average monthly yield is 120 tons of lead ore, producing 74 to 75 per cent of lead, and a proportion of silver, varying from 6 to 8 ounces in the ton of lead.

"A cross lode coursing nearly east and west, and exposed in the rocks on the south of the waterfall, bears traces of galena and copper pyrites, with a little blende; and induced the commencement of an adit level, which it was once proposed to carry onward for the purpose of intersecting all the above mentioned veins. A plan of this kind, which must have been adopted in any district accustomed to mining on a large scale, was not only likely to discover other lodes intermediate between those already known, but would have reached them all at such depths as to render their unwatering comparatively easy, and to obviate the expense of establishing four engine shafts within the small horizontal range of 260 fathoms, a mode of working so costly as in great part to have swallowed up the proceeds of the lead ore which was extracted during the prosecution of the *Ruplagh* mines."

About three miles S.W. of the Seven Churches, in the Valley of *Glenmalure*, there is one very fine vein of lead ore, which has been worked for many years, and many trials have been made and are now making on lodes of greater or less promise. Of the principal vein which runs through the townland of *Ballinafunshoge*, Mr. Smyth writes:—

"This fine mine has suffered under the disadvantage of being at various periods worked in an unskilful manner, which has entailed difficulty and expense on later adventurers; that portion of the lode extending from the surface to the adit level has been almost entirely removed, but in a most irregular way, and the whole is in so ruinous a condition, that it is impossible to approach either of the 'ends' or

extremities of the workings, on which alone an opinion of the farther resources of the vein can be founded."

"The position also of the adit and shaft with respect to each other is so ill-chosen that the apparatus for raising water and minerals is in consequence very disadvantageously applied, and the expenses therefore bear an unnecessarily high ratio to the profits."

The Ovoca mines are next described. These were formerly worked wholly as copper mines, and rich masses of copper ore were at first discovered and worked out. As copper mines, however, their value gradually diminished in consequence of the poorness of the ores, but when the Neapolitan Government, in 1840, practically prohibited the exportation of sulphur from Sicily, Mr. Hudson who then worked Ballymurtagh mine, having sagaciously prepared himself for something of the kind, introduced into the market large quantities of iron pyrites, which he had carefully stored instead of throwing away, and thus converted the Ovoca mines from very poor copper into very rich and profitable sulphur mines.

This iron pyrites, or sulphuret of iron, exists in large quantities in the slate beds along a certain particular band of them which strikes for several miles across the country in a direction about N.E. by E. and S.W. by W., dipping at an angle of 50° or 60° to the S.E. It is partially mingled with sulphuret of copper, which likewise seems to occur in the beds, although in some places putting on the appearance of lodes, some of which are really cross fissures. The Ovoca mines consist of the Ballygahan and Ballymurtagh mines, on the S.W. of the river, and the Tigroney, Cronebane, and Connaree mines, on the N.E. of it, the river itself running down along the line of a great "fault" or heave, by which the beds are thrown down on the N.E., and their place accordingly shifted laterally towards the N.W. The greatest depth to which the levels have proceeded is 110 fathoms, or 660 feet.

"With regard to the working of the mine," says Mr. Warrington Smyth, "unskilful methods were employed for many years, which have repeatedly endangered the whole of the underground ways and those engaged in them. The practice of 'underhand stopeing' was always adopted, from unwillingness to allow time and money for properly opening out the ground, and conducting the operations on the principles recognized as the best in Cornwall, Saxony, the Hartz, &c. During the last few years, the system of 'stopeing in the back' has been introduced, a pair of shafts have been sunk at the extreme western end of the mine, and the 110-fathom level is to be driven at once beneath all the old workings, by which means the stability of the mine, from a certain depth, will be ensured, and the water which must at present be raised by horizontal rods from all the 'bottoms' will be lifted in a direct line."

In Ballygahan mine, in consequence of cutting away the buttresses, a terrific crash took place in 1850, engulfing a house, but fortunately only killing one child.

Such incidents as these, involving loss of life, destruction of property, and precluding the possibility of extracting the rest of the mineral wealth that may be buried underneath, show the absolute necessity that exists not only for improved systems of working, but for the careful construction and registration of mining plans and records, to be kept in a public office and preserved for the use of future generations.

As to the present productiveness of these mines we have the following statistics for the last few years:—

“PRODUCE OF BALLYMURTAGH MINE, County Wicklow.

Year.	Copper ores.	Sold at Swansea.	Sold at other ports.	Gross value.	Pyrites.	Net value.	Paid in wages.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	£	<i>Tons.</i>	£	£
1844	7,130	3,635	3,495	18,166	9,575	7,420	14,429
1845	6,816	2,836	3,930	17,871	11,943	9,337	14,885
1846	7,318	2,564	4,754	16,046	11,023	9,445	14,395
1847	6,012	964	5,048	11,851	12,503	12,928	13,795
1848	7,621	1,317	6,304	15,022	8,969	9,865	—
1849	7,783	1,233	6,550	15,342	9,582	10,540	—
1850	6,754	339	6,415	13,313	14,873	16,360	—
1851	6,026	102	5,924	11,878	21,738	23,911	—

Of the production of Ballygahan mine there is no account.

Of Cronebane and Tigroney we have the following:—

“The copper ores exported from Cronebane and Tigroney and sold at the Swansea ticketings, appear to have been as follows, for the last nine years:—

	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cronebane -	819	1,635	2,325	1,241	137	—	13	—	25
Tigroney -	353	657	644	422	—	—	13	—	—

Of the Connaree Mine, all that is said is—

“Connaree was for some years subjected to a disgracefully bad management, by which the ore was removed without any regard to system or to future consequences, and the workings were crippled and rendered highly unsafe. Much has, however, now been improved; and if a deep adit were driven up from the valley of Ballykean on the east, in such manner as to spare the heavy expenses of pumping, the mine would present considerable promise of future good fortune. A steam-engine of 30 inches cylinder is taxed to its utmost in keeping the water, whilst a whim-engine of 18 inches cylinder is used for the extraction; but the expense in fuel necessarily weighs heavily on the production.”

After discussing the peculiar features of the copper lodes of the Ovoca district, and comparing them with some of those in Sweden, Mr. Smyth makes the following important remarks:—

“We have not in Ireland, it is true, that variety of silicate minerals, nor the combinations of cerium and other rare metals, which characterize the Scandinavian deposits, but the association of copper pyrites with magnetic iron, with chlorite, and large masses of iron pyrites, cannot but suggest a comparison which tends to raise our expectations of the future prospects of the Wicklow mines. * * * * * The mines which we have described (Ovoca) as in active operation, occupy a length of little more than two miles, whilst there remains on the S.W., between Ballymurtagh and the granite rocks of the mountain mass of Croghan Kinshella, a space of above five miles in length, throughout which the same or analogous deposits of ore have been proved to exist at intervals. Appearances of considerable promise have been met with at Ballymoneen, Knocknamohill, Ballycoog, and Moneyteigue, the two latter being in the Carysfort royalty and adjoining Croghan. From various causes no efficient exploration has yet been made in these sets; and it still remains to be proved whether, as in the

Ovoca mines, vast masses of iron pyrites will be found beneath the more mixed ores which occupy the surface, a conclusion very probable, but rendered uncertain by the varying character of the adjacent slate rock.

"The importance of the produce of the Ovoca mines will best be appreciated from the following return, communicated by the Custom House authorities of Dublin, of the quantities of iron-pyrites (sulphur ore) and of copper ore, shipped at the ports of Wicklow and Arklow in each year from 1840 to 1852, both inclusive:—

Years	Iron Pyrites.			Copper Ore.			Grand Total of both Ores.
	Wicklow.	Arklow.	Total.	Wicklow.	Arklow.	Total.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1840	27,172	13,004	40,176	7,065	4,365	11,429	51,605
1841	40,823	36,565	77,388	1,764	3,376	5,140	82,528
1842	20,494	19,963	40,457	5,406	5,776	11,182	51,639
1843	19,995	19,191	39,186	4,292	4,545	8,837	48,023
1844	15,772	19,189	34,961	4,892	5,270	10,162	45,123
1845	9,573	29,445	39,018	4,854	5,042	9,896	48,914
1846	10,815	25,245	36,060	3,958	4,350	8,308	44,368
1847	10,619	29,889	40,508	1,919	2,886	4,805	45,313
1848	15,462	25,777	41,239	307	3,600	3,907	45,146
1849	19,103	26,524	45,627	142	3,800	3,942	49,569
1850	24,221	49,823	74,044	1,493	2,836	4,329	78,373
1851	29,399	73,039	102,438	41	2,023	2,064	104,502
1852	30,770	67,218	97,988	444	2,358	2,802	100,790
Total	274,218	434,872	709,090	36,577	50,226	86,803	795,893

21 cwt. are allowed to each ton of ore."

It might, at first sight, appear anomalous that the quantities of "copper ore" from the whole of the Ovoca mines, were so much less than those previously stated, as produced by one mine alone, namely, Ballymurtagh. It is to be explained in this way, at Ballymurtagh all those ores are classed as copper ores, which contain any copper at all worth extracting. Much of the "sulphur ore" bears a slightly increased price in the market on account of the two or three per cent. of copper it contains, and they are thus reckoned among the copper ores at the mine; they are, however, sent to Liverpool, principally to be used as sulphur ores, only the smaller and richer portion, stated in the latter table, being sent to Swansea to be sold as "copper ores."

Mr. Smyth gives us many historical details as to the working of these, which are interesting, and also speaks of trials, having more or less promise, made at other spots in Wicklow, and at Cairne, near Enniseorthy, and Barry's-town, near Bannow Bay, in the county of Wexford. These, however, are beside our present purpose. Equally so, are the alluvial workings for gold, formerly carried on in the neighbourhood of Croghan Kinshella, of which Mr. Smyth gives an account.

The maps with which the little book is illustrated are a first attempt to print a geological map in colours. The result is not very brilliant, but as a first attempt is a pardonable one, and we may, doubtless, expect improvements in the subsequent trials at the same process.

ART. III.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c. and of Discoveries in general science bearing upon Industrial Arts.*

Process of whitening Pins and Needles made of Iron and Steel. By MM. Vantillard and Leblond.—It is well known that pins made of brass wire are deficient in strength and elasticity, and accordingly they have been replaced by pins made of iron or steel; but it is necessary to tin them over. This operation, however, cannot be performed equally well with iron as with brass; the pins have a rough uneven surface, which renders them inconvenient to use, as they are liable to tear the cloth.

Messrs. Vantillard and Leblond, wishing to avoid this defect, formed the idea of first covering the iron with a thin coating of copper or other metal having a greater affinity for tin than iron has; but in order that this result should be satisfactorily attained, it is necessary to polish and pickle the pins before coppering them. The above named manufacturers have most ingeniously effected the polishing, the pickling, and the coppering, by one single operation. To treat, for example, 2 kilogrammes (a little more than 4lbs. 6½ozs.), 4 litres (about 7 pints) of water, 300 grammes (10 ounces 9 drachms, avoirdupois, by weight) of oil of vitriol, 30 grammes (15 ounces 13 grains, avoirdupois,) of salt of tin, 40 grammes (1 ounce 4 drachms 17 grains) of crystallized sulphate of zinc, (white copperas,) and 7 grammes (about 108 grains, avoirdupois) of sulphate of copper, are mixed together; this mixture is allowed to dissolve during twenty-four hours. The bath being thus prepared, it is to be introduced into a barrel of wood, made pitcher-like, and mounted upon an axis. Into this barrel, which has a capacity of about 35 pints, the pins are now to be put; it is then turned rapidly during half an hour; when the pins will be found to have received a pickling, a polishing, and a slight coppering. After the lapse of this time, 20 grammes (about 10 drachms 8 grains, avoirdupois,) of sulphate of copper, in crystals, (blue stone,) are to be added, and the barrel again turned during 12 minutes, when a solid coppering will be effected, with a finely polished surface. This done, the liquid in the barrel is to be decanted off, and may be used repeatedly for the same purpose; the pins are washed in cold water, then put in a tray containing a hot solution of soap, and agitated for about two minutes. The soap ley is decanted off, and the pins put into a bag with some fine saw-dust and shaken, by which means the coppered surface assumes a brilliant appearance. The pins thus prepared may be tinned in the ordinary way, but the operation can be effected much more rapidly than in the case of ordinary brass pins. The articles made in this way are far more beautiful and useful than those made in the ordinary way. This process is the more deserving of attention at present, quite independent of the superior quality of the pins, in consequence of the exceedingly high price of brass wire.—*Bulletin de la Société d'Encouragement, March, 1853, p. 142.*

A new Hammer for forming and dressing Mill Stones, by which the great danger to the health of the Workmen from the dust produced is avoided. By M. Poirel, of La Ferte-sous-Jouarre.—It is well known that the making of mill-stones and their subsequent dressing when worn down are exceedingly unhealthy occupations. The fine silicious dust gets into the mouth, and finally into the lungs, where it causes phthisis of the most fatal kind. The effects of this disease are so disastrous at the celebrated mill-stone quarries of La Ferte-sous-Jouarre, that attention has frequently been directed to find some means to remedy the evil. This object appears to have been effected by M. Poirel's invention. It consists of an ordinary hammer, with a small reservoir made of brass or tin-plate, somewhat like a smaller hammer, fitted on the handle quite close to the hammer-head. This small hollow hammer has a hole through it exactly like that in the iron one, into which the handle is made to fit; and by means of rings of vulcanized caoutchouc or gutta-percha, it is made to slide water-tight upon the handle of the hammer, to which it is to be attached; an orifice is made in one side of it for the purpose of introdu-

cing water, and is closed by a screw-tap. At one end there is a fine capillary hole through which water can be forced by the shock of a blow with the hammer, but through which air cannot enter. This hole is so arranged that any drops of water which escape from it fall a little above the point of the hammer used in dressing the stone. In working with such a hammer a drop of water is made to fall upon the point with every blow, the effect of which is to make a paste of the silicious dust, and prevent it from flying about. The amount of water is proportional to the rapidity and force of the blows, and consequently directly so to the quantity of dust produced. When one point of the hammer is worn, and that the other must be used, the little reservoir may be turned round on the handle, and thus answers for both ends. The usual sized reservoirs employed are capable of containing sufficient water to last for four hours; and when made of thin tin-plate, or in part of gutta-percha, weigh only about 4½ ozs., so that the weight added to the hammer is very trifling. The time occupied in replenishing the reservoir when empty, would be quite inappreciable.—*Bulletin de la Société d'Encouragement*, May, 1853, p. 229.

Manufacture of Papier-maché from Straw.—During the last year, Mr. P. Warren has obtained a patent for producing a sort of papier-maché-like mass from straw. The process differs very little from that employed for the preparation of straw-paper, now so extensively made in this country, and was, indeed, tried many years ago in Germany. Rye, wheaten, barley, or oaten straw, is first cut into small pieces, and if there are knots in it, it is ground between millstones, or crushing cylinders. The straw thus subdivided, is then boiled in a strong alkaline ley, (caustic soda or potash,) in order to remove the external silicious rind, until it is converted into a pulpy mass. The rapidity with which this is effected depends upon the kind of straw, and the strength of the solution. When sufficiently boiled, the mass is worked up in a rag engine, after which it is partially dried, and in this state, is made into sheets by means of presses or rollers, or it may be at once pressed into the different forms which it is intended to give it. The plates or formed articles may then be dipped in oily or gelatinous liquids, and baked in an oven, in the same way as ordinary papier-maché wares, and finally varnished, inlaid, or otherwise decorated. (A similar material can easily be made with the light surface or flow peat, forming the upper layer of our bogs, and as there is no patent for the employment of such a material, there is a wide field of industry open to any enterprising persons, who would take up the manufacture of papier-maché from it).—*London Journal*, Sept. 1853, p. 193.

Rosin Oil for Lubricating Machinery.—Payen and Buran recommend the oil obtained by the distillation of common rosin with from 5 to 10 per cent. of quicklime, as a good material for greasing machinery. As it is generally slightly acid, even when distilled with lime, it is recommended to add from 2 to 5 per cent. of lime or magnesia to the cold oil, which unites with the free acid, and gives the whole mass the consistence of butter.—*Polytechnisches Centralblatt*, No. 12, 1853.

ART. IV.—*Bulletin of Industrial Statistics.*

PROGRESS OF THE LINEN MANUFACTURE IN IRELAND.

IN the first number of this Journal we gave some statistics, which showed the rapid increase in the growth of flax in this country. The progress of the linen manufacture is no less gratifying, as the following details, summarized from the *Belfast Mercantile Journal* of January 10th, will show. The following table gives the imports and exports of linen fabrics and linen yarns into Belfast during the years 1852 and 1853.—

Imports.			
1852.		1853.	
Linen and Thread	... 771 boxes	... 886 boxes	
Linen Yarn	... 5,532,800lbs.	... 9,013,760lbs.	

Exports.			
1852.		1853.	
Linen and Thread	... 61,930 boxes	... 63,070 boxes.	
Linen Yarns	... 8,616,160lbs.	... 7,889,280lbs.	

The following table gives the relative prices of linen and linen-yarns at the close of the years 1852 and 1853:—

4s. 4d. Light Linens.											
	14 ⁰⁰	15	16	17	18	19	20	21 ⁰⁰			
	d.	d.	d.	d.	d.	d.	d.	d.			
1852, ...	8	8 ³	9 ³	10 ³	11 ³	13 ³	15	16 ³			
1853, ...	8	9	10	11	12	13 ³	16	16 ³			

Yarns.											
	40	45	50	55	60	65	70	75	80	85	90
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1852, L. Warp,	4 9	4 6	4 4 ¹	4 3	4 3	4 3	4 4 ¹	4 7 ¹	4 10 ¹	5 1 ¹	5 6
„ „ Weft,	4 7 ¹	4 4 ¹	4 1 ¹	4 0	3 10 ¹	3 10 ¹	3 10 ¹	3 10 ¹	2 10 ¹	3 10 ¹	4 1 ¹
1853, „ Warp,	5 0	4 9	4 6	4 4 ¹	4 3	4 3	4 3	4 7 ¹	4 10 ¹	5 1 ¹	5 6
„ „ Weft,	4 10 ¹	4 7 ¹	4 4 ¹	4 1 ¹	4 0	3 10 ¹	3 9	3 9	3 9	3 9	3 6

There are now 88 factories in the whole of Ireland, with 580,684 spindles (in 1850 there were only 73). At the close of 1852 there were only 58 power-looms at work in Ireland; there are now 218, and preparation is making for 1,105 additional, making a total of 1,323. One new establishment, that of Messrs. J. & T. Kennedy, has arrangements for 1,100 looms, of which four or five hundred are already set.

From the preceding table we see that the imports of both linen fabrics and linen has considerably increased, and that the export of linen has also increased, but that of linen yarn has decreased. We believe the exports from Newry and Drogheda have also increased, but we are unable to give the amount. The value of the medium numbers of yarn has slightly decreased, although flax has ruled considerably higher throughout the year than in 1852, say fully £12 per ton on an average. It follows from this that the spinning trade has been comparatively unremunerative during the past year, more particularly as the price of coals has risen very considerably, as will be seen by the following table, which shows the relative price of coals per ton at Belfast at the beginning and close of the year 1853:

January 1st, 1853.			Dec. 31st, 1853.		
English,	... 12s. 6d. to 13s.	...	English,	... 19s. to 20s.	
Scotch,	... 9s. to 9s. 6d.	...	Scotch,	... 15s.	

Showing an advance of 7s. per ton on English, and 6s. to 6s. 6d. per ton on Scotch coal. This advance on the large quantity used in Belfast and its dependencies, for manufacturing purposes, reckoned at equal to 130,000 tons per annum, must tell seriously upon the profits of the manufacturer. Notwithstanding this enormous increase the quantity of coals imported into Belfast has considerably increased, as will be evident by the following table of the imports for the last four years:

1850	...	...	...	253,515 tons.
1851	...	...	...	295,513 „
1852	...	...	...	317,313 „
1853	...	...	...	345,670 „

In consequence of the anticipated war the consumption of linen was scarcely so good as at the corresponding period last year; and the stock of linen and linen yarns was also larger. During the first nine months of 1853 both the production and consumption were large, but since the 1st of October the trade has ruled rather dull. The spinners having, however, adopted the wise step of working only forty-eight hours in the week instead of sixty; the stocks have been kept down and the prices to a great extent maintained.

INCREASE OF TRADE IN BELFAST.

Cotton and Sewed Muslin Manufactures.—The influence which the existence of a great branch of manufacture in a locality exercises upon its general trade is well illustrated in Belfast, in the rapid progress of every other species of manufacture, and of its general commerce. Thus, the cotton trade of that town is steadily increasing; there being now employed 111,264 spindles, being an increase of 15,000 spindles over 1852. The consumption of yarns has been much the same as in 1852, as regards quantity, but the quality was superior. Of the 111,264 spindles, 34,360 are occupied in spinning the finer qualities; 39,000, medium; and 37,904, coarse yarns. The same causes which affected the linen trade, especially the high price of coals, have also affected this branch of manufacture. The following table represents the imports and exports of cotton goods for the year 1852 and 1853:

<i>Imports.</i>		1852.	1853.
Cottons & Cotton Wool,	20,215 bales,	12,936 trusses.	6,522 bales, 8,343 trusses.
Cotton Yarn,	... 2,544 "	6,607 skps. & bgs.	
<i>Exports.</i>		1852.	1853.
Cotton Yarn,	1,224 bales, 499 bxs,	1006 skps. ... 1,125 bales,	1,215 bxs. 906 skps.
Calicoes, Muslins,	1,949 "	18,025 pgs.	... 1,004 " 14,343 pgs.

The sewed muslin business, as well as the gingham and printed calico trades, although not, perhaps, so lively or remunerative as they were at the commencement of the year, have been conducted throughout with great activity. The former continues to insinuate its branches throughout Ireland, wherever skilful and willing hands are to be found; and we believe we are within the mark when we say, that about £1,500,000 are spent annually throughout Ireland for wages in this trade, chiefly through the agency of Belfast and Glasgow establishments. It is calculated that upwards of 50,000 looms are at work in Belfast and various parts of Ireland in weaving muslins, calicoes, &c., and which number would be rapidly augmented, were a sufficient supply of skilled labour to be had.

Shipping of Belfast.—As may be expected from the previous statements, a very considerable increase has taken place in the shipping of Belfast during the past year, as the following table, representing the tonnage of all the vessels entering and clearing outwards from that port, during the years 1851, 1852, and 1853, indicates:—

	1851.	1852.	1853.
Steamers,	... 309,783	... 360,620	... 417,516
Sailing vessels in foreign trade,	... 84,716	... 63,297	... 77,631
In cross channel,	... 242,830	... 238,464	... 252,184
In Irish coasting,	... 13,609	... 20,874	... 20,874
	650,938	684,132	768,505
Increase in 1853 over 1851,	...	117,567	
" 1853 " 1852,	...	84,373	

Being equal to an increase of $12\frac{1}{2}$ per cent. on 1852, and 18 per cent on 1851.

Iron Ship-building.—We are glad to find that the trade of iron ship-building has been established in Belfast. Messrs. R. Hickson & Co. have established a building yard on Queen's Island; and had in January last a clipper-ship, intended for the Bombay trade, of 1,400 tons register, in course of erection. They had also completed a contract for another, of 2,600 tons, for the Australian trade; and with a Liverpool house for supplying an iron vessel, which will be the largest iron sailing ship yet built. It is a great source of satisfaction to know that these ships will be all completed with native manufactured iron; all the plates, &c., required for them will be made at the Iron Works in Eliza-street, Belfast, where, we understand, the make of this article has been nearly doubled during the months of November and December. The keels also for these ships are forged with the tilt hammer at these works, and are a very massive piece of workmanship, certainly the largest of manufactured iron for a keel ever made in the Three Kingdoms.

THE

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No. IV.—APRIL, 1854.

ART. I.—INDUSTRIAL EDUCATION. No. II.—*On the State and Progress of Agricultural Education in Ireland.* By M. BROGAN.

It is a self-evident fact, that the successful conduct of any business requires previous training and careful instruction in all its various details; but, to any one who doubts the reasonableness of such a proposition, the lamentable failures that are constantly occurring from men embarking in pursuits, with the principles of which they are but imperfectly acquainted, should afford abundant evidence of its truth. And yet, until a comparatively recent period, there was one pursuit, at least—the cultivation of the soil—which was considered of so simple a character as to exempt it from the application of this fundamental principle of social economy. Any man possessing sufficient capital, no matter how insufficient his intelligence and experience, was considered qualified to have the management of land; and any man whose physical power was well developed, though possessing no other qualification whatsoever, was deemed quite fit to become an agricultural labourer. Fortunately, this stand-still state of matters was not destined to continue. Thinking men began to suspect that something more than *capital* and *labour* was required, in order to make the pursuit of Agriculture as successful as it ought to be;—that the principles of vegetable growth and nutrition, instead of being simple processes, interesting only in theory, form some of the most important subjects of investigation;—that the soil, which was formerly considered of an entirely homogeneous nature, and ranked as one of the “four elements,” under the general name of *earth*, was an extremely compound mass, consisting of various heterogeneous substances, from which the different families of plants derived their nourishment;—in short, that mere “practical experience” was too slow a guide on the path of agricultural progress, and that the aid of theory, the offspring of science, was necessary to enable the agriculturist to meet the constantly increasing demands upon his exertions.

But there is often a wide interval between the recognition of a defect and the application of a suitable remedy, and so it was in this case: years

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elapsed before any attempt was made to establish a school for imparting adequate agricultural instruction to youth. The first effort of the kind appears to have been undertaken in France, in the year 1775, by the Abbé Rozier, but, unfortunately, it failed to secure that attention which its importance deserved, and instead of sympathy and support, it met only with doubt and opposition. A second attempt was, however, made by Dr. Fellenberg to demonstrate the perfect practicability and success of combining agricultural with literary education in his school, established in 1799, at Hofwyl, in the canton of Berne, in Switzerland, and his success having stimulated others to follow in his footsteps, numerous institutions founded on the model of that of Hofwyl are now established in Switzerland and in Belgium, France, Wurtemberg, Prussia, Saxony and Holland.

The introduction of Agricultural Schools into Ireland dates from a comparatively recent period, the first having been founded at Templemoyle, near Derry, in the year 1827, under the auspices of the "North Western Farming Society." This institution was originally modelled exactly on the plan of that of Hofwyl, with separate departments for the education of the higher and lower classes. The former branch had to be abandoned, the latter still continues in successful operation; but it is not to be understood as a school for the very poorer classes, the pupils being generally from that of respectable farmers.

No attempt appears to have been made to bring the masses, the great body of small farmers and agricultural labourers, under the beneficial influence of such a system, until the Commissioners of National Education, observing the great absence of industrial skill apparent in the cultivation of the soil of this country, undertook to apply a remedy, by adapting the kind of instruction to be imparted in their schools to the special requirements of the country. In their fourth report (for the year 1837) they thus allude to the necessity then existing for diffusing a better knowledge of agriculture:

"Considering, too, the very backward state of agriculture in Ireland, and that it forms the only source of employment for a vast number of the labouring poor, we think it particularly desirable that a better knowledge of it should be promoted; and that the schools under us should tend, as far as practicable, to bring forward an intelligent class of farm labourers and servants."

They accordingly determined on giving an industrial character to the training of their teachers, so that they might be enabled to combine industrial with literary instruction, in all National Schools where circumstances might be favourable for effecting such a combination, and thus render their system, as far as possible, one of "*combined literary and industrial education*." The institution of the Model Farm and Agricultural Training School, at Glasnevin, near Dublin, in the year 1838, was the initiation of this useful system, which appears to be well designed to effect a complete and most desirable revolution in the social condition, as well as in the agricultural practices, of the peasantry of this country.

For some years this establishment formed almost the sole agency in the work of agricultural education in connexion with the Board of National Education; but by degrees minor institutions,—offshoots of the parent

stem,—began to spring up in different parts of the country. Still the progress of the movement was comparatively slow, for in 1845, the first year for which we have an authentic account of the number established; we find, from the twelfth report of the Commissioners, that there were five model and seven ordinary agricultural schools in operation; that there were twelve free agricultural scholarships endowed, (besides the twelve free scholarships in the Glasnevin establishment); and that grants had been made towards the establishment of five additional agricultural schools. From this till the close of 1852, (the date of the last official information concerning them,) they have gone on steadily increasing, so that on the 31st December, 1852, there were—

AGRICULTURAL SCHOOLS.					
Model	...	...	...	...	29
Ordinary	...	...	...	...	40
Workhouse	...	...	...	...	23
Total	...	...	...	...	92
AGRICULTURAL PUPILS.					
Boarders, Free	...	...	...	...	63
„ Paying	...	...	...	...	88
					101
Day Pupils	...	...	...	...	2,355
“Paid Industrial Classes”	...	...	...	...	207
Total	...	...	...	...	2,663

Thus during a period of seven years these schools have increased over seven-fold, while the pupils receiving agricultural instruction in them have increased in a far greater ratio.

But the progress of the system is not to be measured merely by the increase in the number of agricultural schools. The scope and efficiency of the instruction imparted in them has been greatly extended and improved, and their organization and supervision more systematically and effectually carried out. In their fourteenth report (for the year 1847), after detailing the principles on which they propose to organize and support agricultural schools, the Commissioners thus proceed:—“The plan we have now explained cannot be effectually worked by our ordinary inspectors. It will be necessary, therefore, that our agricultural schools, including our Model Farm at Glasnevin, should be under the superintendence of a person practically connected with agricultural operations, with plans of farm buildings, and the best method of keeping farming accounts; and who shall be competent to examine and report on the system of agricultural instruction carried out in schools of this description. We have accordingly determined to appoint an officer to discharge this important duty. With his assistance we shall in future be able to make full and satisfactory reports to Parliament of the agricultural department of our system.” In accordance with the intention thus expressed, the Commissioners proceeded to appoint an Agricultural Inspector, in August, 1848, and they selected from among several candidates for the office, Dr. Kirkpatrick, whose zeal in promoting the work of agricultural education, as manager of the Larne Agricultural

School, pointed him out as one well qualified for the performance of the duties of that important office.

In April, 1849, Dr. Kirkpatrick made his first report on the system of agricultural education, and appended thereto we find reports from the conductors of the Larne, Market-hill, and Rahau Agricultural Schools, detailing the improved system of management carried out on the model farms connected with these schools, and the arrangements adopted therein for affording agricultural instruction to the more advanced pupils. Appended to his third report (for the year 1850), we find, for the first time, the "Statistics of the Agricultural Schools," collected and presented in a tabulated form; all the agricultural schools in connexion with the Board being required to furnish annual reports and returns of the proceedings pertaining to their agricultural departments, from which, after careful examination, the "Statistical Table" is compiled.

In connection with his last report (for the year 1852), we find reports from seventy-four agricultural schools; and from a comparison of the results shewn by the "Statistical Table," with that of the previous year (1851) we deduce the following items of progress:—

Particulars of Increase.	1850.	1851.	1852.	Increase in 1851 over 1850.	Percentage increase for 1851 over 1850.	Increase in 1852 over 1851.	Percentage increase for 1852 over 1851.
Agricultural Schools of all classes	69	81	92	12	17.4	11	13.5
Agricultural Boarders	94	96	101	2	2.12	5	5.2
Ditto Day Scholars	1,212	1,726	2,355	514	42.4	629	36.4
Ditto Paid Pupils ("Industrial Classes")	173	181	207	8	4.6	26	14.3
Land Cultivated as Model Farms	A. R. P. 949 3 0 E. S. D. 1086 2 11	A. R. P. 1086 2 11 E. S. D. 1281 2 3	A. R. P. 1281 2 3 E. S. D. 1356 5 11	1356 5 11	14.4	174 3 22	18.4
Amount paid for labour	Not stated in Statistics for this year.	1359 7 31	1650 5 8	..	..	290 13 5	25.4
Value of gratuitous labour of Pupils		648 8 41	976 19 0	..	..	328 10 8	50.7
Net acreable profit on cultivation of model farms		1 11 2	2 3 8	..	..	0 12 6	40.4

Having thus traced the origin and progress of the system, we will now proceed to detail—

1st, Its organization and management.

2nd, The obstacles to its full development.

3rd, The means that should be adopted to extend its operations and increase its efficiency.

4th, The good effects it is calculated to produce.

The agricultural schools are divided into three classes, Model, Ordinary, and Workhouse; we shall treat of each separately: and, first, of Model Schools.

Whenever a farm of land of not less than twelve statute acres in extent, with suitable offices thereon for the accommodation of an adequate quantity of live stock, and for other farm purposes, is connected with a

National School at a convenient distance, and that proper arrangements are made for affording instruction in the theory and practice of improved agriculture to a class of the more advanced pupils, and to a certain number of agricultural boarders, the Commissioners grant an additional salary of £10 per annum to the teacher for affording such instruction and setting an example of skilful and systematic farm management in his neighbourhood; but should the farm be large, and there be a necessity for appointing an agriculturist for the exclusive management of the agricultural department, they will grant a separate salary of £30 per annum to such agriculturist, for conducting the farm operations and affording agricultural instruction.

Nearly all the early founded agricultural schools were established on a very limited scale, and on a very simple and inexpensive plan; but as their utility came to be recognised, it was thought desirable to establish them on a more extensive and efficient basis. To effect this, as well as to maintain them in efficient working order after being so established, required considerable immediate and annual expenditure, which few landed proprietors or patrons of schools, however anxious to forward improvement, would be able or willing to undertake. The Commissioners, therefore, resolved that, in cases where it might be desirable to establish a model agricultural school, and where a large amount of expenditure should be incurred by them in aid of its establishment, they would take the direct management into their own hands, merely requiring a certain amount of local subscription (from £200 to £400) to be invested to their credit before commencing the *building* operations. This determination, with the reasons which induced the Commissioners to depart from their previous practice of allowing the management to remain in the hands of local parties, was announced in their 16th report (for the year 1849); and since that period they have had twelve model agricultural schools established under their own exclusive control. In all these establishments the agriculturists in charge receive certain fixed salaries and allowances (equivalent to about £50 per annum), with furnished apartments, &c. They manage the model farms, not for themselves, but for the Commissioners, are supplied with all the necessary stock, implements, &c., and receive an adequate "imprest" for meeting the "petty expenditure" of the establishments, but they are not permitted to incur any expenditure exceeding £3 without the special sanction of the Commissioners under the advice of the Agricultural Inspector. They are required to transmit monthly accounts of all expenditure and receipts in connexion with their respective farms, which are subjected to a rigid scrutiny in the office, and are submitted for the examination and certificate of the Agricultural Inspector before being finally approved.

Ten years experience in promoting agricultural education, had shown the Commissioners the difficulties attendant on the establishment and management of agricultural schools, on a scale commensurate with their acknowledged importance and utility—had shewn them that, in many instances in which a large expenditure had been incurred in the erection of buildings, the institutions afterwards remained almost inoperative from

want of adequate means to conduct them properly; and that, therefore, much more was necessary on their part than merely the usual grant towards building and the salary of the teachers. But in order to warrant them in undertaking so much increased responsibility, and in order that institutions in which so much of the public property would be invested, and in the success of which the public would be so deeply interested, might be conducted satisfactorily, they determined, in addition to contributing towards the erection of these schools, to supply the means of having them efficiently conducted, and to possess the exclusive control in every case in which they undertook the increased responsibility, leaving it still in the power of local parties who contributed towards the establishment of agricultural schools, and who might be willing to furnish the means of conducting them properly, to retain the management of them in their own hands. Hence the model agricultural schools came to be subdivided into two classes:—

1. Those under local management.

2. Those under the exclusive control of the Commissioners.

Nearly all the model agricultural schools recently established belong to the latter division, and some of those originally conducted under local management, but which failed from want of means to work them successfully, have been transferred to the Commissioners, and are now also included in this class.

An essential feature in the “model” agricultural schools, and which, besides their being on a larger scale, distinguishes them from the “ordinary” agricultural schools is, that they are all intended to receive and educate “agricultural boarders”—young men who, being desirous of acquiring a sound knowledge of agriculture, with the view of practising it on their own account, or of becoming land stewards or agricultural teachers, become resident pupils in these establishments for one or two years. The charge for maintenance and education is fixed at a very moderate rate, and of this the Commissioners pay the greater part, the pupils or their friends being required to pay only £6 per annum. There is besides a “Free Scholarship” in each agricultural school, under the exclusive management of the Commissioners, which is invariably bestowed on the most deserving pupil of the school whose circumstances may render him unable to pay the above annual charge.

The remaining schools in connection with the Board are chiefly of two kinds: the “Ordinary Agricultural Schools,” and the “Workhouse Agricultural Schools.” Wherever a farm of not less than three statute acres is connected with a National School, at a distance not exceeding half a mile, the Commissioners grant an additional salary of £5 per annum to the teacher, on the following conditions:—

1st, “That an ‘Agricultural Class’ of at least *ten* of the more advanced pupils receive *theoretical* instruction in the school, and *practical* instruction on the farm during a specified and convenient time each day.”

2nd, “That the farm connected with the school be efficiently cultivated according to some approved and regular system of rotation, so as to serve

as a *model* of improved management to the pupils and to the surrounding neighbourhood."

3rd, "That the 'house-feeding of cattle,' and the careful collection and skilful application of manures, form characteristic features in the system of farm management to be pursued."

Should the agricultural department be afterwards conducted in a very satisfactory manner, the Commissioners, on the recommendation of their Agricultural Inspector, may award a grant towards the payment of an "Industrial Class" for assisting in the cultivation of the model farm.

How best to train the youthful inmates of our workhouses in habits of skilful and systematic industry—to become a timely reinforcement to the industrial efforts of the country, instead of a constant dead weight on its recuperative energies—is a question that has long engaged the anxious attention of those who seriously reflect on the existing condition of Ireland, and what may grow out of it. Agriculture forming almost the sole employment of the people, agricultural education naturally suggested itself as a feasible and beneficial mode of solving a portion at least of the difficulty, by affording to the people some practicable means of earning an independent livelihood for themselves hereafter. Accordingly, where land happens to be available in connexion with a workhouse, it is now allocated by the authorities for the industrial training of the pauper boys; and in several instances in which it was not originally available, it has been purchased or rented for that purpose.

But for a long time nothing further was done than to place the boys to labour on this land, under the supervision of some workhouse official, who frequently understood nothing of the principles of improved cultivation, or, even if he did, took no pains to instil them into the minds of his pupils, who were generally made to work like mere machines, knowing scarcely anything of the nature or utility of the work they might be employed at, and caring very little about the manner in which it should be performed. In time, however, some intelligent and benevolent guardians, seeing the large amount of useful agricultural knowledge acquired by many of the pupils attending the National Agricultural Schools—seeing no reason why the unfortunate inmates of the workhouse, who were debarred from attendance at these schools, should be debarred from participating in the industrial knowledge they were disseminating—resolved that these boys should be instructed as well as worked; that they should not merely be made industrious, but that their industry should be based on intelligence; that while their *hands* should be employed in useful labour, their *minds* should be employed as well. But how was this combined physical and intellectual training to be carried into effect? The source that furnished the suggestion could also afford the means of practically testing its efficiency. The Commissioners of Education were invited to afford their co-operation, and they replied by resolving to award gratuities of from £10 to £15 per annum to those having the superintendence of the agricultural training, (in all such cases placed under their supervision,) in which the management should be found satisfactory, also to grant the

necessary books for the instruction of those pupils placed in the "Agricultural Class."

Thus originated this class of agricultural schools, and since its institution in 1848, no class has multiplied so fast—there being, at the present date, about fifty workhouse schools, having their agricultural departments placed under the Board; yet they have not increased to that extent which the important benefits resulting from the system itself, and the valuable assistance afforded by the Board of Education towards conducting the system efficiently, would lead us to expect. This seeming apathy on the part of some Boards of Guardians must only be attributed to a misapprehension of the conditions on which this assistance is afforded. In the hope of being instrumental in removing any such injurious doubts or misapprehensions, we will briefly state what we believe to be the views and objects of the Commissioners of Education with respect to agricultural education in workhouses.

No reflecting mind, seeing the vast number of young people who are growing up in our workhouses, but at once discerns that in these lies a mighty agency for future good or evil; that to render them a source of good, and advantage to their country, they should be inured from the beginning to useful labour; and as the value of *skilled* labour must always be immensely superior to *unskilled*, that they should also be thoroughly initiated into the principles of their destined employment. But to effect this requires that the person placed over them shall be fully competent to afford the necessary instruction. The emoluments which a Board of Guardians might feel justified in offering, are generally inadequate to secure the services of properly qualified persons; but even assuming that such persons are appointed in all cases, still, without the regular supervision of some person perfectly conversant with the details of the most approved system of agricultural training and instruction, and capable of affording useful suggestions when necessary, it is obvious that the management is not likely to be satisfactory. To guard, as far as possible, against such a defective mode of management being followed, is evidently the object of the Board of Education, and the aid afforded by them towards the remuneration of qualified agriculturists, as well as the stimulus to constant and active exertions afforded by the visits of their Agricultural Inspector, must tend powerfully towards its accomplishment.

The Board of Education has never sought to assume any arbitrary control over the system of cultivation or agricultural management pursued at workhouses in connection with their system. They allow the details of this management to be entirely a matter of local arrangement between the Guardians and their agriculturist, all that they require being, that some *systematic* course be followed, and that its various details be efficiently carried out. If this be neglected, they withhold the promised aid, which is understood to be contingent on a satisfactory course being adopted, and satisfactory results realised. Thus the aid awarded by them has a better effect in securing constant attention to the efficiency of the agricultural department than a permanent salary of the same amount.

Latterly, the Poor Law Commissioners have recognised the general

desire for the progress of agricultural education in workhouses, and have instructed their Inspectors to impress on the Boards of Guardians in their respective districts the advantages of such industrial education, and the importance of its being conducted in connexion with the Board of Education. This has produced a very sensible effect, the increase of workhouse agricultural schools during the past year having amounted to twenty-seven.

The superintendence of the agricultural schools is committed to the care of an agricultural inspector, assisted by a sub-inspector (appointed August, 1852), whose business it is to visit the various agricultural schools in operation, and to report fully on the state of each, and the degree of efficiency with which it is conducted; to afford suggestions for more improved and judicious management, wherever such may be found necessary; to report on all applications for the establishment of agricultural schools; to examine and certify all the accounts transmitted by the conductors of the agricultural schools under the exclusive control of the Commissioners; to examine the reports transmitted at the close of each year from the various agricultural schools in connexion with the Board; and to make an annual report on the state and progress of the agricultural department generally; as well as to perform the various other duties incidental to the working of the agricultural department which comes within the province of an agricultural inspector to perform.

The chief obstacles to the increase and efficiency of agricultural schools may be classed under the two heads:—1st, Those which retard the increase of agricultural schools; and 2nd, Those which prevent the full efficiency of agricultural schools already established.

The causes which retard the more rapid extension of the agricultural school system arise principally from the embarrassed condition of landed property in this country. Many landowners, who would be anxious for the establishment of agricultural schools on their land, and most willing to contribute liberally towards the erection of the necessary buildings, are as yet unable to do so; while many others possess, under the present laws, leasing powers of so limited a nature, as to preclude them from giving such a lease of the proposed model farms as would justify the necessary expenditure on buildings and other improvements.

The causes which curtail the efficiency of agricultural schools after being established, also arise chiefly from the above-mentioned source. The anomalous condition of land tenures in Ireland is calculated to *repress*, instead of to *encourage*, agricultural enterprise. Few “tenants at will” can be induced to improve their farms so as to establish and carry out a regular and improved system of cultivation. There are not, therefore, those frequent opportunities for the exercise of agricultural skill which otherwise might exist, and consequently there cannot be the same desire for its acquirement; and agricultural schools, and movements towards agricultural improvements, instead of being universally recognised as tending to spread among those destined for the cultivation of the soil, those correct ideas of the principles of this art, which would enable them to employ their labour and capital in the manner most profitable for themselves, are generally

regarded as undertakings established under landlord influence, with the view of affording merely a pretext for the maintenance of *high rents*. It is needless to observe that such a feeling is, with regard to the schools here noticed, as mistaken as it is pernicious; and that the only object which their promoters have in view is, by diffusing abroad the seeds of industrial intelligence, to increase to the utmost extent the productive powers of our soil, not for the exclusive advantage of a class, but for the general well-being of the whole community.

A consideration of the impediments just referred to as retarding the progress of agricultural education, will obviously suggest the means that should be adopted to afford full scope for its efficiency. When the importance and necessity of agricultural education is universally admitted, the provision for affording it should not be allowed to remain dependent on chance, and beset with innumerable difficulties. Whatever body is intrusted with the direction of it, should receive adequate powers to establish and support agricultural schools in all the poorer districts of the country, without requiring as a preliminary condition a certain amount of local contribution. And special facilities should, if necessary, be largely afforded by law, for obtaining land for model farms in connection with such institutions, so as to prevent the possibility of failure from defective title to, or power of transferring such land. Again, in the case of landowners being willing to contribute towards the establishment of agricultural schools on their estates, but whose pecuniary circumstances prevent them from advancing the necessary funds, they should be allowed to make the required amount *a charge on the rental of the model farm* until principal and interest be paid off. There can be little doubt that if this facility were afforded, many such persons, anxious to forward the good work of agricultural improvement, would gladly avail themselves of it, and agricultural schools thus rapidly increase.

To remove the apathy or prejudices of the farming classes towards agricultural education, but two things seem necessary—1st, *To place the relations of landlord and tenant on a fair and equitable basis, and thereby not only remove the barriers to agricultural progress, but open a wide field for the exercise of agricultural enterprise.* 2nd, *To convince them that the improved agricultural principles laid down for their guidance are not crude theories, or doubtful speculations, but FACTS capable of practical realization, in every instance in which a fair amount of skill and industry shall be brought to bear in working them out.* The first of these preliminary conditions may be effected by legislation. The second, it is the province of the *model farms* connected with the various agricultural schools to achieve, by affording in their respective localities satisfactory proofs of the truth and value of the improved principles put forward by them; and from what we have already witnessed, we have no doubt that, with the rising generation of farmers, their teaching and example will be eminently successful. The beneficial effects likely to arise from a widely extended and well organized system of agricultural education can hardly be overrated. The cultivators of the soil, once properly instructed in the principles of improved and skilful cultivation, and trained to regular and systematic habits of industry,

of arranging and conducting their business—will exhibit in their farms, gardens, and homesteads, a gratifying change for the better: while the nation at large will reap no trifling advantages, because increased efficiency and success in developing the productive powers of the soil will be sure to permeate in a current of healthy prosperity through all classes of the community. For, although the circumstance may not be generally recognised, yet it is an indisputable fact, that every other occupation or profession derives its support, either directly or indirectly, from the cultivation of the soil, which may justly be regarded as the basis of all human industry. Accordingly, therefore, as this art languishes or flourishes, so in proportion will those dependent on it assume a weak or vigorous character. By the general adoption of an improved system of agriculture and rural economy, the face of the country will undergo a gratifying transformation. Instead of the spirits being depressed, and the eye offended on every side by the sight of neglected fields, dilapidated fences and farm buildings, undrained swamps, and unreclaimed wastes, the sight will be gladdened by improved and careful husbandry, neatly-trimmed fences, and well-arranged and well-kept farm-steadings:—thorough and artificial drainage will cause the unwholesome swamp to disappear; and industry skilfully directed, and *properly protected and encouraged*, will cause the waste to smile like a garden.

ART. II.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

MINING, METALLURGY, ETC.

Machines for facilitating the Ascent and Descent of Miners.—There is, perhaps, no species of work so exhausting of strength as climbing ladders, and we need not be surprised, therefore, that the workmen employed in very deep mines lose their bodily strength in a very short time, and that their duration of life is very short. To avoid this intense labour, it is usual to bring up the men from the bottom of the shaft in the kibles or buckets in which the ore is drawn up; but besides the enormous waste of time entailed by this slow process, especially in deep mines, great numbers of frightful accidents continually occur. The number of persons who lose their lives by accidents in the mines of Great Britain and Ireland has been frequently set down at 2,500 per annum! The proportion of these deaths occasioned by falling down shafts, especially by the breaking of the ropes in bringing up the miners, has been estimated in South Staffordshire at one-fifth, and in Scotland, Yorkshire, Lancashire, &c., at one-half. In Prussia, and in many parts of the Continent, in consequence of the numerous accidents which have occurred from the breaking of the ropes, it is now strictly forbidden to allow any of the men to come up in the kibles. But as no miners above the age of 30 or 35 years can endure the labour of ascending the ladders in shafts, very frequently from 200 to 400 fathoms deep, machines had to be invented by which they could mount with comparatively little exertion, and with considerable safety. Such machines are now in very general use in Belgium, Germany, France, and to some extent in Cornwall, and in several parts of Great Britain, but, we believe, in no instance in Ireland. As it is, we fear, vain to appeal to the *humanity* of mining companies or

proprietors, we shall lay before our readers the results of some elaborate calculations of Mr. Dieck, the Inspector of Mining Machinery in Westphalia, which show clearly that there is a very great economy in employing those machines, over the ladder and rope system; and it would be well if the fact was universally known, for we have no doubt that if the destruction of the health or the sacrifice of life would do little towards their introduction, the economy would.

The base of these calculations is, that each miner earns ten silbergroschen, or about one shilling, for each shift of eight hours; where the wages are more than that sum, the economy will be greater in the same proportion; and the experimental data are founded upon the experience of four machines worked in Belgium and the north of France. If we assume the number of miners to be 250, and the depth of the shaft to be 150 fathoms, the loss of time entailed by the ascent and descent in each shift of eight hours will be as follows:—

By the ladders,	5 hours.
By the rope and kibbles,	11.72 "
By the machine at the Davy Shaft, near Valenciennes ...	1.7 "
Ditto, at La Reunion Shaft, at Mariemont, at Hennegau ...	0.75 "
Ditto, at the Henri-Gillaume Shaft, at Seraing ...	1.07 "
Ditto, at the Crown Prince Shaft, at Centrum ...	1.5 "

The ascent and descent by the rope requires, therefore—

Twice the time required by the ladder system,

Seven times that on the machine of the Davy shaft,

Sixteen times that on the machine of La Reunion shaft,

Eleven times that on the machine of the Henri-Gillaume,

Eight times that of the Crown Prince shaft,

And twenty times the time required on those now in use in Cornwall.

If we estimate the interest upon the original cost, the cost of maintenance of each system, and the time and strength lost by the workmen, by a money value, the following will be the cost per annum for 250 men and a shaft of 150 fathoms:—

Ascent and descent by ladders	£3,150
Ditto, by ropes	3,021
Ditto, by the machine at the Davy shaft ...	639
" " " La Reunion ...	483
" " " Henri-Gillaume ...	534
" " " Crown Prince ...	678

From these calculations it would appear, that in a mine where 250 men descend and ascend a shaft of 150 fathoms by the rope system, the saving by the employment of a machine—even supposing the very highest price to be paid for it, say £1,650, would not only cover this outlay the first year, but would leave a profit of £693. In a case where the men descend by the ladders and ascend by the rope, the saving by the use of the machine would also cover the outlay in the first year.

In Cornwall, the weekly loss of time sustained by the workmen by the ascent and descent of ladders is estimated at 3s., and by the machines at 9d. In neither of the cases mentioned is the far more important loss of health, and frequently of life, taken into account, or the misery and sufferings of orphans or widows, or the loss sustained by the public by their maintenance. Our space at present forbids our noticing the best construction of machine now employed, but we shall take the earliest opportunity of returning to the subject, and in the mean time we would recommend the preceding calculations to the notice of mining proprietors and mining companies.—*See Bemerkungen über das Maschinenwesen auf den Kohlen-gruben Belgiens und Nord Frankreichs, von Herrn Dieck. Kursten und von Dechens Archiv, Bd. 25, Heft 2.*

Arrangement of the Fuse in the Bore, in blasting operations.—Mr. Braunsdorf recently drew the attention of the Mining Association of Freiberg to the advantage of placing the fuse in contact with the powder in the bottom of the bore, and not with the upper portion merely, as is usually done. He showed that, where strong powder and heavy charges are employed, the upper or weakest part of the bore receives the first shock, and frequently gives way so suddenly that the greater part of the charge is scattered about and produces no effect; but where the whole

charge is fired from the bottom or strongest part of the bore, the greatest possible effect is produced, and the explosion is always regular, no matter what the strength of the charge may be.—*Berg und hüttenm. Zeitung. Jahrgang 12, No 1, S. 14.*

New Form of Safety Lamp.—M. Chuard has been endeavouring to improve the construction of the safety lamp, so as to render it, as far as possible, safe; and although he has not as yet succeeded in reducing his plan to practice, he has been so far successful as to induce a commission of the French Institute to award him a prize of 500 francs as an encouragement to proceed with his praiseworthy efforts. He proposes that the air should only arrive at the flame after having passed through a considerable length of metallic tube, the orifice of which is capable of being closed by a piston, kept suspended by a thread in a particular way. If the quantity of fire-damp should so increase as to produce an explosive mixture, a portion will burn in the interior of the lamp and consume the thread, by which the piston will fall and close the air tube before the flame can pass through the gauze.—*Comptes Rendus de l'Academie, 30th Jan., 1854.*

Reuben Plant's Safety-lamp.—This form of lamp differs from the ordinary Davy in having the wire gauze of argentine or of iron wire electro-tinned or silvered, by which much more light is produced than where the common black iron wire gauze is used. Inside the gauze, which, strange to say, as in the oldest forms, reaches to the oil reservoir! is a cylinder of glass, which narrows somewhat at the point of the flame.—*Repertory of Patent Inventions, October, 1853, p. 238.*

Roasting of Iron Ores with the assistance of a jet of Steam.—In 1843, Von Nordenskjöld recommended some trials to be made in roasting magnetic iron ore containing pyrites, with the assistance of a jet of steam, at the iron works of Dals Bruck, in Russian Finland. The roasting was effected in a kind of reverberatory furnace, prepared by Count Rumford, and was effective, the whole of the sulphuret having been completely decomposed. The pig iron subsequently produced from that ore yielded an excellent bar iron, without the slightest trace of red-sear. Since then the process has been much used both in Finland and in the Ural, as well with charcoal as with waste gas from the tunnel head. In 1845, Nordenskjöld improved the construction of the roasting furnaces, by giving them almost the exact form of the Norwegian and Swedish gas furnaces.

In order that the action of the steam be fully effective in roasting the ore, there must be a corresponding access of air. Steam and sulphuret of iron mutually decompose one another, with the production of oxide of iron and sulphurated hydrogen. If the latter, as fast as formed, meets with a sufficient quantity of air, it will burn, producing sulphurous acid, which in its passage through the ore produces no injurious action. It, however, there be not sufficient access of air, a portion of the sulphurated hydrogen in passing over an oxidized ore, beyond the direct action of the current of steam, would be decomposed, producing water and sulphuret of iron again.

This process of Nordenskjöld is of great importance, independent of the improvement which may be effected in the quality of the iron, by the almost complete removal of the sulphur, inasmuch as it renders the process of roasting the ores, by means of the waste gases from the tunnel head, perfect, and effects so great a saving in the amount of fuel consumed in this part of the process of iron smelting, as to lower the cost of production very considerably.—*Scheerer's Metallurgie, Bd. 1, S. 75, and Bd. 2, S. 77—79.*

On the Composition of the Sheathing of Ships.—M. Bobierre has paid considerable attention to this subject, and has arrived at the following conclusions as to the cause of the rapid destruction of some copper and bronze sheathing:—1. When unalloyed copper is employed, the presence of arsenic appears to hasten its destruction. 2. All bronzes which appear to have stood well, contained from $4\frac{1}{2}$ to $5\frac{1}{2}$ per cent. of tin, that quantity being necessary to form an homogenous alloy. When the per-centage of tin is only 2.5 to 3.5, which is very frequently the case, no definite alloy is produced, and the mass is of unequal composition, and, being unequally acted upon, is soon destroyed. 3. When impure copper is employed, the alloy is never homogenous, and is unequally acted upon in consequence. We thus see

that the so frequent destruction of the sheathing of copper-bottomed vessels arises from the tendency to use inferior brittle copper, and by diminishing the proportion of tin, to economize the difference between the price of that metal and copper, at the same time that the cost of rolling is also less, in consequence of the greater softness of the poor alloy. Bobierre thinks that the addition of a very small portion of zinc very much improves the bronze, by producing a more perfect and uniform distribution of the positive metals, and consequently a much more definite alloy.—*Comptes Rendus de l'Academie*, T. xxxvii., p. 131, and T. xxxviii., p. 122.

Oxidized Silver.—The high appreciation in which ornaments in oxidized silver are now held, render a notice of the process followed interesting. There are two distinct shades in use, one produced by chlorine, which has a brownish tint, and the other by sulphur, which has a blueish black tint. To produce the former, it is only necessary to wash the article with a solution of sal-ammoniac; a much more beautiful tint may, however, be obtained by employing a solution composed of equal parts of sulphate of copper and sal-ammoniac in vinegar. The fine black tint may be produced by a slightly warm solution of sulphuret of potassium or sodium.—*Chem.-Techn. Mittheilungen von Dr. Ellsner, Berlin*, 1853.

Galvanoplastic Niello.—Niello, a peculiar style of enamelling, consists in engraving or stamping figures on a plate of silver or gold, and then filling the incised lines, or impressed pattern, with a sort of enamel, differing, however, from true enamel, which is a kind of glass, by being formed of a mixture of the sulphurets of lead, silver, and copper. This mixture is of a black colour—hence the name niello from *nigellum*, derived from *niger*, black—and when melted into the intaglio parts of a plate, give it somewhat the appearance of an inked engraved copper plate. A new kind of niello work has lately been introduced on the Continent, in which, however, the figures are not produced by an enamel of sulphuret of silver, as in the true niello, but by a different coloured metal, thus on a plate of gold may be produced fine engravings, the lines of which are in silver and so on. This can be effected in two ways; first, by covering the plate to be ornamented with a varnish, exactly as is used in etching, the pattern or ornament is then to be engraved on this varnish, and the metallic surface etched out to the proper depth. On the removal of the varnish with oil of turpentine or ether, the engraved plate is to be placed in a solution of the metal intended to form the pattern, and a deposit allowed to form, in the usual way adopted in all galvanoplastic works. When the intaglio lines have been completely filled up by the deposited metal, the plate is removed from the solution and grounds, when the pattern will be fully developed. The second method consists in sketching the ornament on a sheet of paper with lithographic ink, placing this, with the side upon which the drawing was made, upon a plate of silver or other metal to be ornamented, and pressing them together; the paper is now removed with water, slightly acidified, leaving the ink adhering to the plate, which is to be sprinkled with sand. When the ink has fully dried, the sand is blown away; the plate is placed in a solution of the metal which it is intended should form the ground, and put in connexion with a battery. By this means a deposit will be formed over the whole surface, except the parts protected by the ink; on the removal of the latter with alcohol or spirits of turpentine, &c., the original metal will be exposed, forming a pattern. Many highly ornamental and useful applications might be made of these processes, especially in the manufacture of church furniture. Instead of simply engraving the name and legend upon pieces of plate presented to persons, it might be put in in letters of gold at very little more expense. We recommend these processes to the attention of our silversmiths.

The recent Experiments upon the Metal Aluminium.—Oersted, many years ago, succeeded in obtaining a combination from alumina, the base which, in union with silica, forms so large a proportion of many rocks and of clay, and chlorine. His process consisted in mixing alumina, prepared from alum, with charcoal, and heating the mixture in a porcelain tube to a bright red heat, and then passing a stream of chlorine gas over it. The substance obtained was a solid pulverulent body, of a pale yellow, with a shade of green colour, and readily fusible and volatile. In 1828, and again in 1846, Professor Wöhler, by heating this substance

with potassium, at a bright red heat, formed chloride of potassium, and an insoluble powder, which he considered to be the metallic base of alumina. It had the appearance of powdered platinum, and under the burnisher became tin-white; when rubbed in an agate mortar, it admitted of being pressed into large scales, having a high metallic lustre, and apparently to some extent ductile. It could not be fused in a closed vessel at a temperature at which cast iron melted. M. Sainte-Claire Deville has lately succeeded, by modifying the process of M. Wöhler, to produce the metal in the state of globules, and thus fully study its properties. He heats metallic sodium with chloride of aluminium to a bright redness, until all undecomposed excess of the latter is driven off; there remains a saline mass, in the midst of which are found globules, of various sizes, of pure aluminium. It is a metal of the same whiteness as silver, malleable and ductile in the highest degree; still, when hammered, it offers considerable resistance, and would appear to have the same tenacity as iron. When cold hammered it hardens, but on being reheated it again assumes its original softness. Its point of fusion differs little from that of silver; and its density is only 2.56, or little more than one-third that of iron, and about one-fourth that of silver. It may be melted and cast in the air without undergoing any sensible oxidation. It is a good conductor of heat. Aluminium is completely unalterable in dry or moist air; it does not tarnish, and remains bright alongside zinc and tin freshly cut, which lose their brilliancy. Sulphuretted hydrogen has no action upon it; boiling water does not tarnish it. Dilute or concentrated nitric acid, and dilute sulphuric acid, have no action upon it in the cold. Its true solvent is hydrochloric acid, which forms with it sesqui-chloride of aluminium, with evolution of hydrogen gas; heated to redness in gaseous hydrochloric acid, it produces the same compound in its anhydrous volatile form. It is difficult to account for the great difference in point of fusibility between the substance obtained by M. Wöhler and that just described. A few weeks since M. Chapelle succeeded in obtaining globules of aluminium, by mixing common clay, salt, and charcoal in a reverberatory furnace—a fact of great importance, as it seems to promise that some economical process may be discovered by which it can be prepared on a great scale.

It is scarcely possible to exaggerate the importance of M. Sainte-Claire Deville's discovery, for it fully deserves that name, although he was not the first to prepare aluminium. We have a beautiful white metal, not tarnished in the air, not acted upon by weak acids, fusing only at a high heat, malleable, ductile, and capable of being hardened, and not heavier than glass; it is quite clear, therefore, that if we could discover some process by which it could be isolated from its compounds at a cheap rate, it would have an almost unlimited use in the arts, and might be substituted in a vast number of cases for the other metals. Should this come to pass, it would render mankind almost independent of mining resources, and would do more for the progress of the human race than perhaps any discovery made in modern times. It is certainly curious to observe the rapidity with which physical science is tending to place all nations upon an equality as to natural resources. Few nations possess rich veins of lead, tin, and copper, but clay and rocks containing alumina, are to be found in every part of the globe! Could we but look into the future, what extraordinary changes in the present conditions of things would be revealed to us!—*Comptes Rendus de l'Academie*, Nos. 6 and 8. February, 1854.

MANUFACTURES FROM MINERAL SUBSTANCES.

Results of some recent investigations of M. Vicat upon the destructive action which Sea Water exerts on the Silicates known in the Arts as Hydraulic Mortars, Cements, and Pozzolanas.—M. Vicat, to whom we are so much indebted for our knowledge of the preparation of cements, has recently presented to the French Academy of Sciences, the following *résumé* of the chief general results to which a very long course of experiments upon that very important subject, the durability of cements in marine constructions, has led him:—

1. That the double hydrated silicates of lime and alumina just mentioned are very unstable compounds.
2. That pure water, when poured upon all of them in the state of as fine

powder as can be produced by ordinary means, no matter what might be their age or hardness, will dissolve a portion of their lime, provided they have not been in any way, or at least to a very slight degree, exposed to the action of carbonic acid.

3. That if, under the same circumstances, a very dilute solution of sulphate of magnesia or Epsom salt be substituted for the pure water, the greater part, and often the whole, of the lime existing as silicates passes into the condition of sulphate. If any carbonic acid had previously acted upon it, the carbonate of lime thus formed is not decomposed by the sulphate of magnesia.

4. That all puozzolanas, no matter what may be their ages, require for their complete saturation a very much smaller quantity of lime than is added in practice, especially when we take into account their very imperfect state of division from the rough way in which they are usually prepared.

5. That the affinity of carbonic acid for the lime in combination in these various silicates is so strong, that it is possible, with the aid of a little moisture, to completely neutralize it, wherever it can penetrate, and thus leave all the other constituents of the cement, whether in combination or not among themselves, as mere mixtures in the mass.

It follows, from these results, that sea water will destroy every cement, mortar, or puozzolana, if it can penetrate into the mass immersed in it. As, however, certain of these compounds are perfectly durable when constantly immersed in sea water, they cannot have been penetrated by it. Its penetration has been prevented by the surfaces, and the source of this inability to penetrate is chiefly caused by a superficial coating of carbonate of lime, which has formed either anteriorly or posteriorly to their immersion, and which in time augments in thickness. The effect of a kind of cementation produced by the decomposition of the sulphate of magnesia, of the sea water, and the deposition of carbonate of magnesia in the superficial tissue of the mass, and the formation of incrustations and of submarine vegetation, contributes also to this impermeability. But all such superficial impermeable coatings are not attached with the same force to the mass which they envelop. The differences which have been observed in this respect depend in some cases upon the chemical constitution, and upon the peculiar cohesion of the silicates, and in others upon their submarine situation, relative to the action of the waves and the rolling or dashing of shingle upon them. Hence the differences which have been observed by engineers in the durability of concretes of which such silicates form the gangue.

M. Vicat is preparing a memoir, in which he will attempt to explain the nature of the chemical constitution of those silicates which are durable, compared with those which are not; and which will show the preponderating influence of silica in such phenomena. He will also point out a simple and certain method of classifying all such compounds, as to their fitness or not for submarine constructions; and thus will assist in very much shortening the time necessary at present for testing them by exposure to the action of sea water. From the great practical importance of the subject, and the attention at present directed to it, this memoir will be looked forward to with considerable interest.—*Comptes Rendus de l'Academie*, No. 4. January, 1854.

Manufacture of Paraffine from bituminous Shale.—The process of distilling bituminous shale, first effected on a large scale by Selligie in France, is now carried on with great success by Wiesmann & Co., at Beuel, near Bonn, on the Rhine. The paraffine is employed in the manufacture of candles, and has been found to *compete advantageously with wax and spermaceti*, at 66 $\frac{2}{3}$ dollars (£10 5s. 4d.) the 100 lbs., or something more than 2s. per lb. The lightest volatile oil obtained has a specific gravity of 0.730, and like the benzol of coal tar, is well adapted for cleaning clothes, gloves, &c., as a solvent for various resins, &c. It is also mixed with the denser oils, and produces a mixture of a specific gravity of 0.830, which is used as camphine in lamps. It is of a light straw colour, and is sold in zinc jars, at the rate of 30 dollars (£4 12s. 6d.) per 100 quarts, or somewhat less than 1s. per quart. The fixed oils are rendered drying, and are employed for painting external wood-work, &c. It is also occasionally burned for the production of fine lampblack for the manufacture of lithographic and letter-

press printing. A quantity of asphalt is also obtained, which is used for various purposes; and a greasy stuff, which is used for lubricating the axles, &c. of corves and other waggons in mines, &c. The success of this manufacture is very encouraging for the promoters of the similar one from turf, now completed near Athy.—*Polytechnisches Centralblatt*, No. 19, p. 1213, 1853.

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

Bonelli's Electro-magnetic Jacquard Loom.—This machine, which has created so much attention, and which is destined to do away with the cumbersome harness and pile of cords of the ordinary jacquard loom, consists essentially of a metallic cylinder, placed in connection with a battery or magneto-electric machine. Upon this cylinder the pattern is described by means of a varnish; immediately over the cylinder is placed a frame-work with a number of pointed wires, exactly like a comb. Each of these wires is placed in connection with a coil of copper-wire, rolled round a bar of exceedingly soft iron forming an electro-magnet. If a current of electricity be passed through the cylinder at the same time that it revolves, all the points that are in contact with the unvarnished part of it will be able to conduct the current to the coils of wire, and render the bars of iron magnetic. The latter immediately attract armatures of soft iron placed below, and each of which is connected with a leaf of heddles, which is thus drawn up, and, with it, the part of the chain or warp connected with it. As the cylinder, however, is unequally coated with varnish, the points will be alternately in contact with the metal and varnish; but, as the latter is non-conducting, the moment a point passes from the uncovered metal to a varnished part, the current of electricity is broken, the bars cease to be magnetized, and the armature with its leaf of heddles falls. By this alternate rising and falling of each armature, as the contact is made or broken by the points in contact with the revolving drum, the pattern is worked. The principle is, in fact, somewhat like that of a German automaton organ, with this difference, that, in the latter, the opening and shutting of the stops is effected by raised wires upon the surface of the drum. It would, perhaps, be also the best arrangement for breaking contact in the loom, and we would accordingly recommend some person to try it. Instead of a cylinder, an arrangement of plates moved to and fro has also been tried.

A writer in the *Courier de Lyon* has made some very strong objections to the practical application of Bonelli's ingenious idea. He states that the arrangement of the pattern upon the cylinder occupies eight times as long as the preparation of the cords of an ordinary jacquard; that errors are more readily committed in this operation, and more difficult to be rectified. It is difficult to so arrange the points in connection with the cylinder or plates as that the taking place and breaking of contact should occur at the right moment. The setting-up of the pattern costs seven or eight times as much as the card pattern; further, the latter can be copied with great facility, whilst Bonelli's arrangement costs as much for setting up the second, or copy, as the first, or original pattern. And, finally, the setting-up of the new loom costs double as much as the old. Several of these objections are groundless, especially that about the cost of copying a pattern, which could be done with great facility as soon as it becomes an object of trade to do so. We do not say that M. Bonelli has, as yet, succeeded in producing a machine as perfectly practical as the ordinary jacquard, but we have not the slightest doubt that his machine is the germ of a mechanism which will completely supersede that beautiful contrivance, and, perhaps, render it practicable to work the most complicated patterns by steam or other power. Already, indeed, M. Maumené has, it is said, made considerable improvements in it, which render it very effective.—*Moniteur Industriel*, No. 1795, 185; *Courrier de Lyon*, Nov., 1853; *Comptes Rendus de l'Académie*, 9 Jan., 1854.

M. Raguenet Roland's Dents for Reeds of tempered cast steel.—The reed employed to maintain the threads of the chain or warp in their relative position, and to guide them regularly during their upward and downward motion, is one of the most important elements in the mechanism of weaving. The dents which compose it should be strong, notwithstanding their slight thickness, and elastic

although short; the substance of which they should be composed should be hard and of a high polish, in order to diminish their wearing action upon the warp; and finally, they should be arranged in the reed with the greatest regularity. The number of dents in a reed, for cloth of a given width, necessarily varies with the nature and kind of tissue to be produced. For certain silk fabrics, for example, there are sometimes as many as 150, and more, dents in an inch. It will hence be easily understood, that the execution of a perfect dent, under such conditions, is not without difficulty, and that the nature of the material and the form of the dents influence the qualities of the reed. The dents are sometimes made of iron, sometimes of copper, and sometimes of a kind of reed; hence the name.

The hardest material, and consequently iron, is in general employed for the reeds having the finest and closest dents, intended for fabrics with very fine and close tissues, and which are not intended to be woven moist. The materials of less rigidity, such as copper and reed, are only adapted for coarse fabrics, such as calicoes, coarse woollens, &c. The form of the dents is in general rectangular, and, therefore, of uniform thickness throughout their length. A great many attempts have been made, from time to time, to make dents of tempered and polished cast steel, and to substitute for the rectangular the lenticular form, in order to unite the more certainly all the qualities which have been just mentioned; but whether the execution of these dents offered too many difficulties, or were imperfect, or were too expensive, they never came into use. M. Ragnenet was not discouraged by these failures, or by the difficulties of the problem, and has accordingly been, to a great degree, successful. He now manufactures considerable quantities of cast-steel dents, of a lenticular and sage-leaf form, either tempered or untempered. There can be no doubt that these articles will supersede all others in the weaving of silks, and will be especially prized by the manufacturers of that delicate fabric, velvet. Experience has fully proved that these dents prevent the warp from ravelling, and allow the pile to be cut more perfectly, and consequently gives a sharper and evenier pile, free from all white particles, which is a great fault in this kind of work. There is also so great a facility of working with these dents, that it is said the workman is able to do a sixth more work in the same time; and, finally, their great durability fully compensates for their greater price.—*Bulletin de la Société d'Encouragement*, August, 1853, p. 420.

Perreaux's Dynamometer, for measuring the strength of Thread.—All woven fabrics should have the same strength in every direction. This is especially the case in sailcloth, and other articles subjected to considerable straining force. Such is, however, rarely the case; sometimes the warp is the stronger, sometimes the weft. As a woven fabric is much better when the warp and weft are capable of equally resisting to the same strain, it is manifestly an object to the manufacturer, at least to the honest one, to ascertain the relative strengths of his warps and wefts. This is still more necessary in the case of sewing threads, whether of silk, linen, or cotton, and, accordingly, instruments have been invented for the purpose. Hitherto, however, these instruments have been very imperfect, and have not afforded reliable results. The needle which should indicate upon a dial the force of rupture, and remain stationary when the rupture had taken place, usually oscillated to some slight extent, owing to the rapidity with which the spring of the instrument resumed its initial position. The surface of the dial was in general too small, and hence the closeness of the degrees very often led to errors of observation. The mode, too, of attaching the samples of thread to be examined was so defective, that it became a cause of rupture; and, finally, the form of the instruments was generally inconvenient, and they were very liable to get deranged. All these imperfections have been remedied in an instrument invented by M. Perreaux (14, Rue la Prince, Paris), which, although some time before the public, and perhaps known to some of our readers, we think worthy of having attention directed to. M. Perreaux's instrument is especially valuable at this moment, as it affords an accurate test of the strength of the flax fibres produced by the different patented systems. The mode of attaching the thread to be tested, in this instrument, has no influence whatever upon the rupture, whilst the arrangement and size of the dial are such, that the slightest variations worth noticing may be accurately marked. No matter how rapidly the rupture may take place, or what the force employed

may be, the needle instantly stands still, and in this way guarantees the accuracy of its indications. Each instrument has also attached to it a graduated copper scale, which indicates the elasticity and the extensibility of the thread, data of as much importance to the manufacturer as the force necessary to produce rupture. It would occupy more space than we could allocate to the purpose to describe the machine in detail, and besides it is questionable whether it could be understood without diagrams. We have, therefore, given the address of the maker, and for a description and drawings, refer to the *Bulletin de la Société d'Encouragement*, June, 1853, p. 294.

On the different machines employed for hammering Sole Leather.—In 1840 De Bergue patented a machine for compressing leather without beating it, consisting essentially of a roller attached to the end of a lever. In 1842, Pernet employed, for the same purpose, a kind of laminating machine, consisting of two rollers, which admitted of being placed at any required distance from one another, and thus enabling the degree of compression to be exactly regulated. Before 1842, some manufacturers heated the anvil employed with the old tail hammers, formerly used in tanneries, by steam. One of the next contrivances was that of Ogerean, who made the base upon which the leather was placed in De Bergue's machine, elastic, by placing it upon a beam of wood, resting upon its ends. In the same year also (1842) Flottard and Delbut placed the ordinary anvil upon springs, in order to give elasticity. In a machine constructed by Farcot for Delbut, the hammer instead of being moved by a lever had a vertical motion, in a cast iron frame-work, somewhat in the manner of a pile-engine; the intensity of the blow being regulated by a brake, which formed part of the frame-work through which the hammer moved, and which produced any degree of friction required.

In the year 1842, Berendorff patented a machine, which consisted of four essential parts: 1, a vertical moveable stamp; 2, an anvil, upon which the leather to be hammered was placed; 3, a lever or beam turning on a pivot; and 4, a rotating mechanism, which set the beam in motion. The stamp is connected with the beam, and its upward and downward motion is entirely effected by the motion of the latter. The opposite end of the beam is connected with a crank on the axle of a fly-wheel, the rotatory motion of which is converted by the beam into an oscillating one, which alternately lifts and sinks the stamp, and thus compresses the leather. The anvil fits freely into a thowl or socket in a cross piece of cast iron, and is supported upon a cross beam resting on its ends. This kind of support gives great elasticity, and admits of the leather being properly squeezed, but not injured by too great pressure.

In 1852, Jean and Scellos patented a very curious machine for this purpose, which is founded upon the principle of the ordinary steam hammer. The machine consists of an upright cylinder, closed at top, having a piston moving up and down in it. To the under side of this piston is attached a piston-rod, which works through a stuffing-box in the bottom of the cylinder, and to which a kind of stamp or hammer is attached; under this hammer is placed an anvil, supported on two springs. If steam be admitted into the cylinder below the piston, the latter will be driven nearly to the top, and will compress the air in the cylinder above it, if the steam be now turned off, the weight of the hammer attached to the piston-rod, and the elasticity of the compressed air above the piston, will cause the latter to descend. By this alternate ascent and falling, a piece of leather placed upon the anvil may be hammered in a very few minutes. By means of a proper mechanism the height and velocity of the fall may be carefully regulated, and almost any degree of compression attained, at the same time that the rapid blow is converted into a kind of crushing motion.—*Armengaud's Génie Industriel*, No. 33, 1853.

Hydraulic Axle-cushion for Centrifugal Machines used in cooling Wort.—Although neither the principle of hydraulic axle-cushions, or the use of the centrifugal machine for the cooling of wort are new, we believe that it will be interesting to many of our readers, especially in Ireland, to bring the subject under their notice. In large breweries and distilleries, the cooling of the wort is a tedious and expensive process, and requires a great outlay of capital in

buildings for the purpose. By the use of a modification of the centrifugal machine, so much employed in sugar making, and in drying cotton and linen fabrics, immense volumes of wort may be cooled with extraordinary rapidity, and with a great saving of expense. The more rapidly the machine turns, the greater will be the quantity of liquid which can be cooled in a given time; but as the speed increases, so will the friction and wear and tear of the machine, where the ordinary system of journals is used. M. Barthelemy of Paris has succeeded in obtaining a velocity of 3,000 revolutions per minute, by supporting the upright axis of the machine upon a surface of oil instead of in a solid socket of brass. He makes, in fact, the end of the axis of the centrifugal machine form the piston of a hydraulic press, in which oil is substituted for water, the pressure being constantly maintained by the same power which sets the machine in motion. By this means the whole weight of the axis, with its revolving drum of wort, is supported upon a column of oil, and is completely prevented from coming in contact with any solid body during its revolution. He has constructed upon this principle a centrifugal machine weighing nearly two tons, which worked for several years without the axle-box requiring the slightest repair.—*Moniteur Industriel*, Nos. 1,494 and 1,495. 1850.

Alcoholometric Thermometer.—It is very often of great importance to be able to readily determine the per-centage of alcohol contained in wines, beer, cider, and other similar liquids, and which, as is well known, cannot be determined by taking the density or specific gravity, as in the case of spirits. M. Conaty, adopting the principle of the instrument proposed by M. Jabarié of Montpellier, and of the Abbé Brossard-Vidal, of Toulon, has contrived a very simple and practical instrument, which is made for sale by MM. Lerebours and Secretan of Paris. The principle upon which it is founded is, that the boiling point of any mixture of alcohol and water will vary between that of the former and the latter in direct ratio to the relative proportions of the two in the mixture. The instrument consists of a small copper vessel, in which a little of the liquid to be examined can be boiled by the aid of a spirit lamp, and a common mercurial thermometer, with a moveable scale divided into 100 parts, the division representing the proportions of alcohol. The mode of using it is simple and expeditious; a small quantity of the wine or beer to be examined, is put into the copper vessel and heated until it boils, when the instrument will at once indicate the per-centage of alcohol present. But as the boiling point of all liquids varies with the pressure of the atmosphere, if the mercury of the barometer which indicates that pressure falls considerably, the instrument if graduated upon the supposition that water boils at 212°, which it only does when the barometer stands at 30 inches, would indicate too high a per-centage. To obviate this difficulty the scale is made moveable; and if a little water be boiled in the vessel before making the experiment, and the thermometer plunged into it, the true boiling point in the then condition of the atmosphere will be obtained with sufficient accuracy, and by moving the scale until the point marked O corresponds with it, the instrument will give true results. This instrument is now used by the custom-house officers, and in the hospitals of Paris.—*Journal de Pharmacie*, Nov., 1851, p. 383.

IMPROVEMENTS IN THE MANUFACTURE OF TEXTILE FABRICS.

Schöller's Felted Cloth.—M. Schöller, of Brünn, in Moravia, has invented a peculiar kind of cloth, composed of a thin woollen or cotton cloth, upon which is felted a quantity of wool by a felting machine. The wool or other felting material is laid upon the cloth upon which the felt is to be formed, and both passed between several rollers, and then through a kind of devil, which spreads the wad evenly, and removes the excess of wool. Further on, a solution of soap, soda, and some other of the usual ingredients used in felting, flows upon the cloth, while it passes through another series of rollers, where the felting operation is effected. The fabric thus produced is quite remarkable; it has the appearance of beaver cloth, and is as elastic, and adapted in an eminent degree for winter clothing.—*Geceer-beblatt aus Württemberg*, No. 44, 1853.

IMPROVEMENTS AND INVENTIONS CONNECTED WITH CHEMICAL PROCESSES.

New Mode of Preparing Hemp.—M. Cloux, of the firm of *Cloux fils et Comp.* of Tracy-le-Mont, in the department of Oise, has invented a process for the preparation of hemp, which is considered of great importance. By this process the hemp can be easily, rapidly and cheaply bleached, without injuring the strength of the fibre; at the same time that it becomes as soft and silky as flax. Yarns of the finest numbers may be readily spun out of it, and a linen manufactured from it, which is far superior to that made with flax, and very much cheaper.—*Moniteur Industriel*, 13th Nov., 1853.

Method of rendering a coating of Glue or Size impervious to Water.—If a coating of glue or size be washed over with a decoction of 1 part of powdered gall nuts in 12 parts of water, boiled down to 8 parts and strained, it becomes hard, and as solid and impervious to water as a good coating of oil-paint—a kind of leather, in fact, is formed. As the tannic acid of the gall nuts can only act upon the moist glue, the decoction must either be used while the former is still fresh, or such a quantity of it must be used as to soften the glue. Such a coating would, no doubt, be worth trying upon ceilings, to prevent water penetrating from the floor above and staining them; and might also be beneficially used in houses as a coating under room-papers, especially in so damp a climate as Ireland. We suppose catechu would answer as well as gall nuts for this purpose.—*Polytechnische Centralhalle*, 1853, p. 592.

To render White Flannel not liable to become Yellow in keeping.—If flannel goods be washed in a ley made with 6 parts of Marseilles or other neutral soap (not resin soap) and 2 to 3 parts of caustic ammonia, of the ordinary strength, dissolved in 200 pints of water, and then well rinsed with water, they will not become yellow in keeping.—*Mittheilungen. d. Hannoverischen Gewerbevereins, Lieferung* 66, p. 157.

Vulcanized India-rubber as a substitute for Whalebone, Steel, and other Elastic Materials, in the Manufacture of Parasols, Corsets, &c.—A patent has been taken out for a horn-like substance, which may be formed by melting 2 parts of caoutchouc with 1 of sulphur. This mixture, while warm, may be kneaded and rolled into sheets or other forms, and has sufficient strength and elasticity to form the ribs of parasols, and for the other purposes to which whalebone is usually put.—*London Journal*, October, 1853, p. 289.

Starch Glaze.—It is well known that white wax has been used from time immemorial by the laundress to assist in producing a fine polished surface upon starched linen in the smoothing of shirts and other articles of wearing apparel. It has also been used, as well as stearic acid, in factories, in the getting up of fine bleached goods. Some time since, a substance came into use, in small cakes, under the name of American 'Starch Glaze,' which appears to have been nothing more than stearic acid. Mr. Denyer proposes, instead of selling the stearic acid separately, to mix it with the starch, in the proportion of 1oz. of the acid to 1lb. of starch. The purest stearic acid is reduced to a fine powdered, which is easily effected in a cold vessel, and mixed with the powder starch and sifted. The greatest success has attended the use of this mixture, and it has found great favour with washerwomen. We hope some of our manufacturers will prepare it. *Polytechnisches Journal*, Bd. 126, s. 435.

Brilliant Shining Varnish for Caoutchouc, such as Over-shoes, &c.—M. Fritz Sollier, of Paris, states that a brilliant varnish, possessing the suppleness and durability of the caoutchouc itself, may be prepared by melting vulcanized caoutchouc, with constant agitation, in an iron pot. When fully liquid, and without waiting until it cools, small quantities of oil of turpentine, or of naphtha, or rectified coal tar naphtha, are to be added, until a liquid is obtained having the composition of 1 of vulcanized caoutchouc to 15 of the solvent, after which it should be filtered, and a small quantity of ordinary caoutchouc varnish added to it, to give it more suppleness. Two coats of this varnish are to be laid on, and, when dry, are brilliant in proportion as the solution was limpid and dilute, and the drying made with care, and protected from all dust. Another process of M. Sollier, adapted for varnishing small objects rapidly, is the following:—

Vulcanized caoutchouc,	...	...	...	1
Ordinary caoutchouc,	...	...	...	4
Essential oil,	...	...	...	28

It is only necessary to dip the small object in this solution, and to expose it to the sun, when a very brilliant, supple, and adherent coating of varnish will be obtained. — *Bulletin de la Société d'Encouragement, August, 1853, p. 429.*

New method of quick Tanning with Catechu.—M. Antoine Serruys, of Brussels, has lately patented in England a system of quick tanning, the principle of which is, according to his specification, as follows: a solution made by boiling 300 pounds of catechu in 578 gallons of water, is first prepared, and introduced into a proper formed vat, at a temperature of about 90° Fahr. Into this the skins (the proportion of water and catechu above given, being calculated for about 100 calf or other skins of 15lbs. weight each), previously unhaired by any of the usual processes, are to be introduced, and daily handled or manipulated, the liquor being at the same time well stirred. During the following 15 days the handling is only performed every third day. The skins are now taken out of the liquor and placed on wooden frames to dry. Two-thirds of the liquor in which the skins had been steeped, is drawn off from the vat, and replaced by an equivalent quantity of water, to which 40lbs. of oil of vitriol has been added. The skins are introduced into this mixture, care being taken to keep them fully extended. On the following day they are to be taken out, the fluid stirred about, and the skins again introduced into it, and allowed to remain so for 48 hours, after which they are allowed to dry upon wooden frames, then steeped for three or four days in water, when the process is considered to be terminated.

When hides are to be tanned the catechu solution must be made stronger, and the process lasts longer. In order to tan 100 hides of from 50 to 60lbs. each, a solution of 2,000lbs. of catechu in 440 gallons of water is required. The hides are laid in this liquor, and kept well distended during the first 10 or 12 days, or until their colour becomes uniform; they are daily handled, and the liquor well agitated; in the next 32 days they are handled every eighth day, and during the following 45 days on every fifteenth day, at the termination of the latter period they are to be dried upon wooden frames. To the liquor in the pit or tank from which the hides had been removed, 92lbs. of alum dissolved in 440 gallons of water, and 200lbs. of oil of vitriol, are to be added, and the whole well stirred. The hides are introduced into this mixture, taken out and handled on the following day, and then allowed to remain in the liquor for three weeks, after which they are dried upon wooden frames. The residual tan liquor is withdrawn from the tank, the hides laid in the latter, which is then to be filled with water, in which they are allowed to soak for four or five days, when the process of tanning is considered to be complete.

Instead of alum, Epsom salt may also be employed, but the alum, as experience has shown, makes the skin harder. When the Epsom salt is used, the skins, instead of being placed in a solution of catechu, to which the solution of the salt is added, as in the case of alum, are laid in a liquor, prepared by dissolving 6 cwts. of catechu and 8 cwts. of Epsom salt, in 600 quarts of water. In this liquid they are allowed to remain for from 30 to 50 days, according to their weight; after which they are soaked in water, as before described. — *Repertory of Patent Inventions, Dec., 1853, p. 443.*

Artificial Wood.—MM. Barthe and Potin have succeeded in making a kind of papier-mâché, if we may be allowed to use that term, quite different from anything hitherto produced. They mix sawdust of different woods with glue, and work the mixture into a sort of plastic mass that can be moulded into any desirable form. When sufficiently dry, it is *tanned* in a peculiar way. The products obtained in this way, in imitation of different woods, are said to be very beautiful.

Process for rendering Casks oil-tight.—Büttger has proposed a process for rendering casks oil-tight, and thus avoid the great loss at present sustained by leakage. Good crown glue is to be steeped in cold water for twelve hours, and then heated to about 160° to 170° Fahr., and a strong syrup of treacle added in the proportion of one part of the syrup to three parts of glue. This mixture is to be applied to the

inner sides of the cask, previously well dried, either with a brush, or by pouring a quantity of it into the cask and rolling it rapidly about. He considers this process preferable to saturating the wood with a boiling solution of glauber salt. —*Böttger's Polytechnischen Notizblatt*, No. 22, 1851.

MISCELLANEOUS PROCESSES AND INVENTIONS.

Turf as a Material for making Papier Maché and Carton Pierre.—In our last number, in speaking of a patent which had been taken out for the manufacture of papier-maché from straw, we recommended some one to try turf for that purpose, as *hitherto* no one had patented the use of that material. In this, it seems, we were in error, for not only has a patent been granted, but even a company has been formed to carry it out, under the very imposing title of the "Limnoplasic Company." If this company claim the sole right of making papier-maché from turf, we can only tell our readers that they are at full liberty to infringe the patent whenever they please, as the idea of making papier-maché from turf has become public property long since, we ourselves, even, having recommended it fully nine months ago. If it be only the peculiar process by which it is proposed to make it which is claimed, we have nothing further to say, especially as we do not know the nature of the process.

Raw Material for Paper-making.—As there is now a very great scarcity of rags for the manufacture of paper, it may be of interest to direct the attention of manufacturers to an excellent substitute for them, and one of which an almost unlimited supply can be had—namely, the fibre of the plantain. Immense quantities can be obtained from British Guiana.

Photography on Lithographic Stones.—The great desideratum in photography hitherto has been, to obtain images directly upon a lithographic stone, from which impressions could be produced, or upon plates of copper, so that by some simple process they may be etched. The first step to effect the latter object has been made by M. Niepce de St. Victor; and the former, which had hitherto baffled all attempts, appears to be also in a fair way to be successfully carried out. One of the first, and certainly the most important, steps made towards the discovery of photographic action, was that of M. Niepce, who found, that if a plate covered with a varnish of bitumen or other resin be exposed to the action of the sun-light in a camera-obscura, the bitumen underwent a curious change, the part most strongly acted upon by the light lost the property of dissolving in oil of lavender, while the portion unacted upon readily dissolved. A few months since MM. Lerebours, Bareswil and Lemercier, probably led by this discovery of Niepce, covered a stone with a kind of resinous ink, they then placed it in a camera-obscura, and covered it with a negative picture produced on glass with collodion, and exposed it to the sun-light, after which it was washed with oil of lavender, or some other solvent of the same character, which dissolved out the parts unacted upon, and left a perfect positive drawing upon the stone, which was further treated in the usual way in which lithographic stones are prepared after the drawing has been made upon them. In this way they have succeeded in producing a number of views of the chief buildings of Paris. M. Hermann Halleux has obtained similar impressions by a totally different process. He prepares a light lithographic stone, with the particular grain required for chalk drawings, and then saturates it by repeated washings with weak solution, but as nearly neutral as possible, of oxalate of iron, taking care that the solution sinks as deeply as possible into the surface of the stone. The stone thus prepared is sensible to the action of the light, and may be kept for any length of time if kept in perfect darkness. Such a prepared stone moist, but not wet, when placed in a camera, will undergo a peculiar change, and if it be then washed with carbonate of ammonia, an image will be brought out, and at the same time fixed, whilst all soluble unaltered salt may be washed away. In order to use such a stone for printing it must be etched as ordinary lithographic stones are, but with a different fluid; the substance used for that purpose is a very dilute solution of oxalic acid. In other respects all subsequent treatment is the same as is usually followed by

lithographers.—For *Lerebours', Bareswits', and Lemerrier's process*, see *Comptes Rendus de l'Académie*, T. xxxvi. p. 878; and for *Halleux's Die Kunst der Photographie*, Leipzig, 1853, p. 104.

Schneider's Relievo Maps.—Although this patent has been taken out more than twelve months since, we think a notice of it may interest those of our readers who have not previously heard of it. Properly executed maps, shaded so as to produce the effect of relief, are very useful to the tourist, and if correctly executed, would be of immense service to the civil engineer, geologist, &c. Schneider's mode of producing such maps is as follows:—He first prepares a model of the district, made either of a mixture of zinc white with strong paste, or of wax; from this he takes a cast in some metal, or a matrix, by the galvanoplastic process. He then copies this with a machine for engraving medallions, of a sufficient size, upon a plate of copper covered with an etching ground, giving greater force to the shadows with the graver. The plate thus prepared is then etched with weak nitric acid, the lighter lines once, and the darker ones twice. When all the details have been in this way transferred to one or more plates, the impressions are printed off in the ordinary way, or polychromic maps may be produced in the same manner as chromo-lithographic impressions. This system, which the inventor calls "optical relief," may be applied to all maps and globes.—*Repertory of Patent Inventions*, July, 1853.

INVENTIONS AND PROCESSES CONNECTED WITH FOOD, AGRICULTURE, AND RURAL ECONOMY.

Loss sustained by Coffee in roasting.—Lebreton has examined the loss sustained by coffees of different growths, when roasted so as to assume a chestnut brown colour. Porto-Rico, Rio, Martinique, and other coffees of a green tint lost 18 to 20 per cent. Malabar, Ceylon, Bourbon, Mauritis, Guadeloupe, Jamaica, and all yellowish, pale, or white varieties, lost from 16 to 18 per cent. And finally, Mocha, and other analogous coffees lost, 14 to 16 per cent.—*Comptes Rendus de l'Académie*.

Mode of Preventing the Potato Disease.—A short time since a small book was published in Russia, by Professor Bollman, under the auspices of the government, upon the potato disease. According to this, the buds which potatoes throw out may be perfectly protected from disease by exposing the potatoes to a sufficiently high and continuous temperature to dry them. He took a quantity of potatoes intended for seed, and dried them during a month in a hot chamber, cut the larger ones into four parts and the smaller ones into two parts, and left them to dry for another week. They had then become so hard as to render it very probable that their germinating power was destroyed, nevertheless, when sown, they germinated, and produced excellent potatoes three weeks before any of the others sown at the same time; and while the potatoes in the surrounding fields were diseased, not one of those so treated exhibited the slightest tendency to disease.—*Mittheilungen der Kaiserlichen, freien Oekonomischen Gesellschaft zu St. Petersburg*.

Fern Leaves as a substitute for Alva, Straw, &c. for Beds.—M. Ulbrich brought under the notice of the Forestry Association of Silésia, at its last meeting at Ohlan, the fact that the fronds of the common *aspidium*, if collected just when the leaf-stalk has withered, and if the latter be removed, make a most excellent and agreeable bed, and retain their elasticity even for years. The beds made of this material and coarse linen are said to be particularly healthy and conducive to cleanliness. In Ireland, withered fern leaves have been used for sleeping upon when spread upon the floor, but not as regular beds. They would certainly be much preferable, in consequence of their little tendency to decay, to the semi-rotten heaps of straw or filthy beds of chaff so generally used.—*Landwirthschaftliche Dorfzeitung*, No. 52, through *Polytechnisches Centralblatt*, No. 3, Feb. 1854.

On the artificial production of Leeches.—M. Borne, a grocer, of Saint-Arnoult, in the Department of Seine-et-Oise, appears to have solved the important problem of the artificial production of leeches, so long considered a desideratum in medicine. By studying the habits of the leech, as the Vosgian peasant, Remy,

did those of fish, he has succeeded in establishing, near his native place, a regular factory of those animals. His establishment consists of a piece of bog, about two and a-half acres in extent, surrounded by a trench full of water, destined to protect his nursery from enemies of various kinds, of which the leech appears to have many. The half of this area is occupied by a number of basins filled with water, at present amounting to 28. These basins are usually about $6\frac{1}{2}$ yards long, 9 feet 9 inches wide, and about 3 feet 3 inches deep. In the centre of this species of island a hut has been built, in which a superintendent always resides, whose business it is to keep off enemies of all kinds, especially birds, water-rats, and several kinds of insects.

M. Borne, having observed that the leeches liked to warm themselves in the sun in winter, and to lie in the shade in summer, accordingly constructed small promontories of earth, one facing the south and the other the north, where they might congregate in each of those seasons. He also found that they deposited their eggs in small galleries, which they formed in the soft earth on the borders of the ponds; these he made himself, by forming a number of zig-zag channels reaching to the edge of the water, with his fingers, and covered over with the stiff mud which he removed. The leeches at once occupy these channels, and deposit their eggs, which M. Borne removes from time to time, and places in a small basin by themselves, where the process of hatching is performed. He has also discovered the mode of feeding them, which is not the least ingenious part of his invention. He takes a quantity of blood, which he beats with switches to separate the fibrine, which he has found to injure them; he then places a number of the leeches in a small flannel bag, which he plunges into the blood, where he leaves them for a certain time, according to their state of health and age. They are afterwards washed with tepid water, and those that have not eaten are carefully separated, to prevent them from preying on the others as soon as their appetite would become developed.

It would occupy too much space here to describe the several other ingenious contrivances which he has adopted, and we must, therefore, refer those of our readers who take special interest in the subject to the *Report of M. Soubeiran to the French Academy of Medicine*.

ART. III.—*Bulletin of Industrial Statistics.*

COMMERCE OF THE UNITED STATES OF AMERICA IN THE YEAR 1850-51.

During the quinquennial period, commencing 1846-47, and ending 1850-51, the declared values of the imports and exports in dollars were as follows:—

Years.	Imports.	Exports.	Re-exported.	Total.
1846-47	146,545,638	150,637,464	8,011,158	305,194,260
1847-48	154,998,928	132,904,121	21,132,315	309,035,364
1848-49	147,857,439	132,666,955	13,088,865	293,613,259
1849-50	178,138,318	136,946,912	14,951,808	330,037,038
1850-51	216,224,932	196,689,718	21,698,293	434,612,943

The average of the first four years above quoted was only 309,469,980 dollars, so that the total commerce of 1850-51 showed an increase of 40 *per cent.* over the average for those years. The total commerce of France in 1851 amounted to 2,614 millions of francs, or £104,560,000; a sum only exceeding that of the United States, which was £93,000,000, by £11,560,000. The cause of this extraordinary and exceptional increase is attributed on the one hand to the development of agriculture and manufactures, and on the other, to the consequent increase in the consumption of foreign articles. Another, and perhaps not less powerful

cause, was the immense tide of emigration which for several years has been flowing from Ireland, Great Britain and Germany, and which reached its maximum in the years 1849, 1850, and 1851, and an idea of which may be formed from the following numbers, representing the total number of immigrants into the single port of New York for those years:

1849,	221,799
1850,	226,287
1851,	289,601

Total 737,687

The influence of this enormous number of the most energetic and active part of the population of the countries just mentioned, must have undoubtedly contributed to a very large extent to the rapid development of agriculture, and to the construction of internal means of communication, without which such development would have been impracticable.

The following table shews the countries between which the commerce of 1850-51 was divided, arranged in the order of their relative importance:—

Table shewing the relative value of the Commerce of the United States, with each of the following countries.

Countries from whence Imported and to where Exported.	Value of Imports.	Value of Exports, the produce of the United States.	Value of Exports, the produce of Foreign Countries.	Total.
	Dollars.	Dollars.	Dollars.	Dollars.
England, Scotland, and } Ireland }	94,847,886	109,531,612	8,414,403	212,793,901
France	31,715,553	25,302,088	2,950,061	59,967,699
Spanish } Cuba ...	17,046,931	5,239,276	1,284,847	23,571,054
W. Indies } Porto Rico, &c.	2,480,329	961,410	57,209	3,498,948
British Colonies of N. America }	6,693,122	9,060,387	2,954,536	18,708,045
Hanseatic Towns, (Hamburg, Bremen, and Lubeck) }	10,008,361	5,405,956	641,491	16,055,808
Brazil	11,525,304	3,128,956	623,960	15,278,220
China	7,065,144	2,155,945	329,342	9,550,431
Spain	2,162,573	5,416,044	138,547	7,717,164
British West Indies	1,222,610	4,697,920	187,045	6,107,575
Belgium	2,377,630	2,709,393	142,619	5,229,642
Chili	2,734,746	1,608,877	286,428	4,630,051
Argentine Republic	3,265,382	659,852	414,916	4,340,160
Holland	2,052,706	1,911,115	284,054	4,247,875
British East Indies ...	3,336,335	512,906	175,484	4,024,725
Sardinia, Tuscany, and the Roman States } Hafti }	2,051,897	1,736,834	127,406	3,916,137
New Granada	1,889,968	1,679,372	167,918	3,737,258
Venezuela	695,606	2,507,701	533,121	3,736,428
Mexico	2,380,295	854,779	189,746	3,424,820
Austria	1,804,779	1,014,690	567,093	3,386,562
Russia	730,788	2,265,573	230,894	3,227,255
Other Countries	1,392,782	1,465,704	145,987	3,004,473
	6,744,205	6,863,331	851,186	14,458,722
Total	216,224,932	196,689,718	21,698,293	434,612,943

If we represent the imports, exports, and total commerce, each by 100, the following table will shew the per-centage of each, which belongs to Europe, as a whole, Great Britain, France, Cuba, Canada, and other British North American possessions, and Germany as represented by the Hanseatic towns.

Table shewing the relative proportions which the Exports and Imports of several Countries to and from, bear to the whole Commerce of the United States.

Nation.	Imports.	Exports.	Total.
Great Britain and Ireland	43 per cent.	55.6 per cent.	48.9 per cent.
France	14.6 "	12.8 "	13.8 "
Cuba	7.9 "	2.6 "	5.4 "
Canada and other British N. } American Colonies ... }	3 "	4.5 "	4.3 "
Hamburg, Lubeck, & Bremen	4.6 "	2.7 "	3.6 "
All other parts of the world	26.9 "	21.8 "	24 "
Europe as a whole ...	68 "	79 "	72 "

Our very limited space does not permit us to specify the chief articles composing the imports and exports of the United States, we shall, however, enumerate a few of the chief, especially those interesting these countries.

	Total Value.	Proportion imported from the chief Exporting Countries, as follows:—		
	Dollars.		Dollars.	
Silk, raw and spun; Silk) Fabrics, plain and) dyed, &c. ...)	26,205,143	France	11,181,210	
		Great Britain and Ireland,	10,041,755	
		Hanseatic Towns ...	2,757,566	
		China	1,839,153	
		Italian States ...	253,766	
Cotton Yarn and white) and printed Cotton) Fabrics)	22,921,093	Great Britain ...	17,780,589	
		France	2,244,112	
		Hanseatic Towns ...	2,011,587	
		Great Britain ...	13,378,504	
		France	3,343,657	
Woollen Yarn and Wool-) len Fabrics ...)	19,507,309	Hanseatic Towns ...	1,750,667	
		Belgium	493,930	
		Great Britain ...	16,456,338	
		Sweden and Norway	941,286	
		France	244,919	
Pig and bar Iron, Steel,) and articles manufac-) tured therefrom ...)	18,876,888	Ireland and Great Britain	9,461,026	
		France	1,452,391	
		Great Britain ...	1,108,612	
		Great Britain ...	717,580	
		Italian States ...	336,483	
Linen Fabrics and a little) Linen and Hemp Yarn)	9,680,623	France	182,274	
Leather	2,815,669			
Straw Bonnets, &c. ...	1,471,691			

Exports.

		Total Value.	Principal Countries to which exported.	
		Dollars.		Dollars.
Raw Cotton—	lbs.	112,315,317	Great Britain and Ireland	79,720,854
Sea Island, or			France	18,124,512
Long Staple			Spain	4,387,262
Cotton ...			Belgium	2,145,270
Short Stpl. &c.			Hanseatic Towns ...	2,060,979
918,937,000			Austria	2,025,184
			Russia	1,297,164
			Italian States ...	1,231,837
			Netherlands ...	589,523
Total	927,237,000		Sweden and Norway	571,616
		10,524,331	Great Britain and Ireland	4,573,009
Wheaten Flour, 2,202,335	brrls. or 3,858,970 cwt. }		Other Countries ...	5,951,322
Leaf Tobacco, 85,945	...	9,219,251	Great Britain ...	3,458,885
hogsheads ...	...		Other Countries ...	5,760,366
Manufactured Tobacco,	...	1,143,547	Great Britain ...	258,723
7,272,780 lbs.	...		British N. Amer. Possessions	442,425
Cotton Fabrics ...	...	7,241,205		

	Total Value. Dollars.	Principal Countries to which exported.	Dollars.
Maize or Indian Corn, } 3,426,811 bushels ... }	1,762,549	Great Britain and Ireland	1,354,879
Salt Pork, 165,206 barrels } Bacon & Hams, 18,027,000 } lbs. }	4,368,015	(Great Britain and Ireland (Other Countries ...	1,587,351 2,781,664
Lard, 19,683,000 lbs. }			
Live Pigs, 1,030 in number }			
Salt Beef, 90,648 barrels }			
Tallow, 8,198,000 lbs. }			
Hides and Calf Skins, in } number, 86,624 }	1,689,958	Great Britain and Ireland	895,783
Live Cattle, 1,350 head }			
Butter, 3,995,000 lbs. }			
Cheese, 10,361,000 lbs. }	1,124,652	Great Britain and Ireland	641,774

The items in these exports of most importance to Ireland are those of provisions, such as salt pork, beef, butter, &c. This branch of trade is rapidly increasing, and will, undoubtedly, be a formidable rival to the corresponding one in this country, as soon as the quality of the articles produced, which at present is very bad, shall have become better, with the rapidly improving agriculture of the Western States.

AMERICAN COTTON TRADE.

Raw Cotton.—The following table represents the total export of cotton from the United States, its value and average price per pound, from 1821 to 1850.

Year.	Sea Island or Long Staple.	Ordinary Cotton.	Total.	Value.	Average Price per lb in cents.
	lbs.	lbs.	lbs.	Dollars.	Cents.
1821	11,344,066	113,549,339	124,893,405	20,157,480	16.2
1822	11,250,635	133,424,460	144,675,095	24,035,058	16.6
1823	12,136,688	161,586,582	173,723,270	20,445,520	11.8
1824	9,525,722	132,843,941	142,369,663	21,947,401	15.4
1825	9,665,278	166,784,629	176,449,907	36,846,649	20.9
1826	5,972,852	198,562,563	204,535,415	25,025,214	12.2
1827	15,140,798	279,169,317	294,310,115	29,359,545	10.
1828	11,288,419	199,302,044	210,590,463	22,487,229	10.7
1829	12,833,307	252,003,879	264,837,186	26,575,311	10.
1830	8,147,165	290,311,937	298,459,102	29,674,883	9.2
1831	8,311,762	268,668,022	216,979,784	25,289,492	9.1
1832	8,743,373	313,471,749	322,215,122	31,724,682	9.8
1833	11,142,987	313,565,617	324,698,604	36,191,105	11.1
1834	8,085,937	376,631,970	384,717,907	49,418,402	12.8
1835	7,752,736	379,606,256	387,358,992	64,961,302	16.8
1836	7,849,597	415,781,710	423,631,307	71,284,925	16.8
1837	5,286,971	438,924,566	444,211,537	63,240,102	14.2
1838	7,286,340	588,665,957	595,952,297	61,556,811	10.3
1839	5,107,404	408,516,808	413,621,312	61,238,982	14.8
1840	8,779,609	735,161,192	743,941,061	63,870,307	8.5
1841	6,257,424	523,966,676	530,204,100	54,330,341	10.2
1842	7,254,099	577,462,918	584,711,017	47,593,464	8.1
1843	7,515,079	784,782,027	792,297,105	49,119,805	6.2
1844	6,099,076	657,534,379	663,633,455	54,063,501	8.1
1845	9,389,625	863,515,371	872,905,996	51,789,643	5.92
1846	9,388,533	538,169,522	547,558,055	42,767,341	7.81
1847	6,293,973	520,925,985	527,219,958	53,415,818	10.34
1848	7,724,148	806,556,283	814,274,431	61,998,294	7.61
1849	11,969,259	1,014,633,011	1,026,602,269	66,396,967	6.4
1850	8,236,463	627,145,143	635,381,604	71,984,616	11.3
1851	8,299,655	918,937,430	927,237,089	112,315,317	12.11

The preceding table includes three decennial periods; and if we calculate the averages for each of these periods, we shall obtain the following very interesting results:—

	First period, 1821 to 1830.		Second period, 1831 to 1840.		Third period, 1841 to 1850.
Average price per lb. ...	13·3 cents.	...	12·4 cents.	...	8·19 cents.
Total value in pounds } sterling.	£5,268,055	...	£10,858,441	...	£11,364,677
Total number of lbs.	203,484,362	...	425,732,992	...	699,478,799

The exportation of raw cotton from America increased, therefore, from 1831 to 1840, to the extent of 209 per cent. over the preceding ten years; from 1841 to 1850, by 343 per cent. over the same period; and by 164 per cent. over the ten years, ending 1840. The exportation of 1851 compared with that of 1821, shews the enormous increase of 743 per cent. And as the United States supplies more than three-fourths of all the raw cotton consumed in Europe, the production of cotton fabrics has probably increased in the same ratio, or perhaps even in a greater. This is, without question, one of the greatest and most important social facts presented by the history of modern commerce, as it shews an undoubted and considerable improvement in the physical condition of a large section of the human race.

Progress of the Manufacture of Cotton Fabrics in the United States.—In 1825, the total consumption of raw cotton in the factories of the Union, amounted to only 80,000 bales, or about 30,340,000 lbs. In 1835 this quantity increased to 216,000; in 1845 it was estimated at 390,000; in 1851 at 550,000; and finally, in 1852 it had increased to 603,049 bales, or nearly double the quantity of raw cotton exported from the United States to France in 1851. The following table gives the consumption in the American factories since 1839:

Year.	Bales.	lbs.	Year.	Bales.	lbs.		
1839 ..	276,018	...	104,682,000	1846 ...	422,597	...	160,274,000
1840 ...	295,193	...	111,961,000	1847 ...	427,967	...	162,310,000
1841 ...	297,288	...	112,750,000	1848 ...	531,772	...	201,680,000
1842 ...	267,850	...	101,584,000	1849 ...	518,039	...	196,472,000
1843 ...	325,129	...	123,308,000	1850 ...	487,769	...	184,990,000
1844 ...	346,744	...	131,506,000	1851 ...	550,000	...	208,593,000
1845 ...	389,006	...	178,404,000	1852 ...	603,000	...	228,693,000

The manufacture of cotton fabrics has, therefore, doubled in twelve years, and has now nearly reached the condition of that of Great Britain in 1830. The perseverance and commercial intelligence of the Americans has enabled them to open up important markets for their cotton manufacture, where hitherto it was unknown. American cotton fabrics appeared for the first time in the Liverpool markets, in competition with the British, in 1846. Increasing quantities are now sent to the Indian and China markets. The exportation of American cotton goods to Canton, dates as far back as the year 1827, but its value at that time was only estimated at 9,000 dollars, or about £1,848; since then it has been rapidly increasing, and in the year, ending the 30th of June, 1851, the export to that city was valued at 1,894,418 dollars, or about £388,997, forming a little more than 41 per cent. of the value of the tea imported into the United States from China. This extraordinary rapid growth of the cotton manufacture in the United States, notwithstanding the high price of labour, clearly indicates that the other economic conditions for the successful prosecution of this branch of industry, are of the most favourable character. America is rich beyond example in coal; has the power to produce cheap iron; is in possession of the raw cotton; and has the most complete system of canals, railways, and navigable rivers, which give her facilities of communication and transport equal perhaps to England itself. The day is not far distant, therefore, when the United States will, perhaps, be able to monopolize nearly the whole cotton trade of the world. The following table contains the values of cotton fabrics exported from the United States, from the

years 1826 to 1851, and the countries to which the exports were made for the years 1840, 1850, and 1851:—

Table of the Values of Cotton Fabrics of American manufacture exported from the United States from 1826 to 1851.

Year.	Total Value of Fabrics in Pounds Sterling.	Mean Values of Exports in Pounds Sterling.	Year.	Total Value of Fabrics in Pounds Sterling.	Mean Values of Exports in Pounds Sterling.
1826	£231,414	£238,679	1841	£632,247	£671,474
1827	235,782		1842	603,329	
1828	204,858		1843	650,151	
1829	257,825		1844	586,110	
1830	263,519		1845	885,533	
1831	227,735	£390,254	1846	711,225	£925,799
1832	247,834		1847	816,096	
1833	498,600		1848	1,139,131	
1834	410,188		1849	993,957	
1835	566,914		1850	968,587	
1836	456,461	£618,647	1851	1,479,249	
1837	568,741		1852	1,534,500	
1838	737,317		1853	1,753,800	
1839	607,303				
1840	723,415				

Progress of Manufactures.—In 1850 there were 8,500 miles of railway laid down in the United States, and 15,000 of telegraph wires. The capital engaged in manufactures was estimated at £108,829,568; the value of the raw materials employed, at £112,935,318; the sum paid in wages, at £49,284,188; the value of the articles manufactured, at £209,445,485; and the number of persons employed, at 1,050,000. According to this estimate, the average wages of all persons engaged in manufactures, would be £46 18s. 7d. per annum, a sum which is tempting enough to induce emigration for a long time to come, when compared with average wages in Europe.

NAVIGATION.

General Navigation of the United States.—The following table contains the number and tonnage of all vessels under every flag, trading to and from the United States, from the year 1846 to 1851:—

	Inwards.		Outwards.		Total.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
1846-47	14,229	3,321,705	14,370	3,378,998	28,599	6,700,703
1847-48	17,274	3,798,673	17,329	3,865,439	34,603	7,664,112
1848-49	20,200	4,368,836	20,313	4,429,433	40,513	8,798,269
1849-50	18,512	4,348,639	18,195	4,361,002	36,707	8,709,641
1850-51	19,710	4,993,440	19,986	5,130,054	39,696	10,123,494

In the year 1851, 75 per cent. of the whole value of the imports, 70 per cent. of the exportations, and 67 per cent. of the re-exportations, was transported in American ships.

That is, 73 per cent. as to value of the whole trade of the United States, was effected in American bottoms, and 27 per cent. in foreign. The following table represents the distribution of vessels and tonnage, according to nation, engaged in the trade of America, in the year 1850-51:—

Belonging to	Number of Vessels.	Tonnage
The United States, ...	18,225	6,254,868
Great Britain, Ireland, and Colonies, ...	18,912	3,112,039
Hanseatic Towns, ...	584	219,678
Swedish, ...	406	128,375
Spanish, ...	344	85,858
French, ...	195	51,860
Dutch, ...	135	41,673
Prussian, ...	107	33,935
Russia, ...	72	30,246
Sardinia, ...	111	29,821
Denmark, ...	84	17,089
Austria, ...	35	14,848
Belgium, ...	42	13,314
Sicily, ...	50	12,698
Chili, ...	53	11,855
Peru, ...	40	9,741
Others, ...	301	55,596
	39,696	10,123,494

According to this table 61 per cent. of the tonnage belonged to the United States, which is less favourable to them, than the comparison of the values of the merchandize transported, given above. The vessels trading under the British flag, therefore, formed a little over 30 per cent. of the whole tonnage engaged in the trade of the United States. Of this, however, the British possessions figure for 1,965,237 tons; and the direct trade between Great Britain and Ireland, and America, for 792,777 tons. So that the trade of the British North American possessions with the United States, in vessels carrying the British flag, formed nearly one-half of the whole trade effected in foreign bottoms.

Between the 30th of June, 1847, and the 30th June, 1851, the whole tonnage engaged in the trade of the United States increased 32 per cent.; the portion of it effected by it in vessels under the American flag, by 30 per cent., and under the British flag by 33. The tonnage engaged in the trade between Great Britain and Ireland, under all flags, increased by 24 per cent.; under the United States by 23 per cent.; and under the British flag by 23. It would thus appear that the repeal of the navigation laws enabled Great Britain to gain a slight advantage of 3 per cent. over the United States in the general trade, whilst in the cross trade between the two countries, the same relative positions were maintained. Nearly the whole of this increase may, however, be set down to the advantage of the British North American colonies. There is another fact also worthy of remark, namely, that while the whole trade of the United States with every part of the world, increased by 32 per cent.; that with Great Britain and Ireland only increased by 24 per cent. The following table shews the total number of vessels under all flags, and their tonnage engaged in the trade between the United States and the British colonies of North America, and between the former and Great Britain, for the year ending the 30th of June, 1851:—

	Inwards.		Outwards.		Total.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
British N. American Possessions ...	10,875	1,952,334	11,244	2,139,638	22,119	4,091,972
Great Britain and Ireland ...	1,805	1,175,146	1,221	953,104	3,026	2,128,250

It may be interesting for our readers to know the extent of the trade between the United States and Cuba, in connexion with the attempts made by the Americans to obtain possession of that fertile island. In the year 1850-51, the

number of vessels which cleared outwards for Cuba was 1,750, representing 391,674 tons; the number which cleared inwards was 1,785, representing a tonnage of 408,677, or a total of 3,535 vessels, and 800,351 tons, or very nearly 10 per cent. of the whole trade of the Union.

Total effective Commercial Navy of the United States.—In 1850 the total tonnage owned by the States was 3,535,454, of which 1,491,882 tons was employed in long voyages; 1,755,796 in the coasting trade; 146,016 in the whale fishery; 85,646 in the cod fishery; and 58,111 in the mackerel fishery. In 1851 the total tonnage was 3,771,439, of which 1,546,378 was engaged in long voyages; 1,896,401 in the coasting trade; 181,644 in the whale fishery; 87,475 in the cod fishery; and 59,539 in the mackerel fishery. The total number of vessels built in the United States, in 1850, was 1,360, representing a tonnage of 272,218; of these 247 were barques and other vessels of three masts, 117 brigs, 547 schooners, 290 sloops and large canal boats, and 159 steamers. In 1851, the total number of vessels built was 1,367, representing a tonnage of 298,203; of which 211 were barques, &c., 65 brigs, 532 schooners, 326 sloops, and 233 steamers. Since 1830, the tonnage of the American commercial navy has nearly quintupled, whilst the mean tonnage of the vessels constructed has followed the following progression:—

In 1820, the mean tonnage was	89.5
" 1830, " " "	91.2
" 1840, " " "	135.7
" 1850, " " "	273.8

In 1850, the total tonnage of steam-vessels was 525,947; and, in 1851, it was 583,607—an increase of 57,760 tons.

Shipping and Trade of the Port of New York.—In 1850, the total tonnage of vessels which cleared inwards was 1,154,000, of which 734,000 tons were under the American flag, and 420,000 under all others. The total tonnage of the vessels which cleared outwards was 983,000, of which 597,000 was American, and 386,000 foreign, making a grand total of 2,137,000. In 1851, the vessels which cleared inward had a total tonnage of 1,449,000, of which 957,000 was American, and 492,000 foreign; the total tonnage of the vessels which cleared outwards, 1,230,000, of which 793,000 was American, and 437,000 foreign, making a grand total of 2,679,000, or an increase over 1850 of 542,000 tons. From 1821 to 1851, the importations into New York increased by 227 per cent.; the exportations by 379 per cent.; the re-exportations of imported goods by 32 per cent.; the duties received by 296 per cent.; the total tonnage clearing inwards by 742 per cent.; the American part of which increased by 511, and the foreign by 3,000 per cent.; the total tonnage clearing outwards increased by 693 per cent., of which the American increased by 450, and the foreign by 3,870; the whole shipping, inwards and outwards, having increased by 796 per cent.

Financial Condition of the five great Arteries of Communication between the Valley of the Mississippi and the Northern and Eastern States, in 1850:—

	Length in Miles.	Capital Sunk. Dollars.	Revenue in 1850. Dollars.	Cost of Working. Dollars.	Net Profit Dollars.	Per Centages upon Capital.
Erie Canal	364	7,143,789	2,926,817	400,000	2,506,817	35.
Pennsylvania do.	395	12,381,824	1,550,555	996,502	553,963	4.4
Northern Railway from New York	450	20,323,581	1,063,950	513,412	545,538	2.68
Erie Railway	327	14,669,152	2,896,042	1,005,948	1,890,094	12.6
Baltimore & Ohio	179	7,227,400	1,387,000	800,000	587,000	8.1
Total	1,715	61,745,746	9,724,364	3,715,862	6,083,412	9.85

—Summarized and calculated from documents published by order of Congress, *Hunt's Merchants' Magazine*, and the *New-Bedford Shipping List*.

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ART. I.—*On an Application proposed by M. Minotto of the properties of the Wedge for improving the methods of transmitting Motion in Machinery.** By HENRY HENNESSY, M.R.I.A., Librarian to Queen's College, Cork.

AMONG the most usual methods of transmitting motion from one part of a machine to another are trains of wheels, acting on each other either by friction alone, or more frequently by the contact of projecting teeth placed along their edges. The disadvantages of both of these methods have been so long recognized, that it would be almost superfluous to point them out; and any proposal which would be likely to remove such disadvantages must be regarded with considerable interest. In order to transmit force by a train of wheels, it is essential that their surfaces of contact should adhere with a force greater than that required to be transmitted. This adhesion will depend—1st, upon the nature of their materials; 2nd, the form of their surfaces of contact; and 3rd, the pressure at these surfaces. The second of these conditions is that to which the improvement proposed by M. Minotto refers. He proposes that the edges of every alternate wheel in a train of gearing should be indented with a groove of trapezoidal section, the other wheels having each a corresponding truncated wedge-like projecting rim. The properties of the wedge immediately explain the

* The views of M. Minotto were first published in Italian, at Turin, and attracted a great deal of attention last year on the Continent, having been examined or noticed in several scientific journals, and having been made the subject of a report to the Institute of France by M. Poncelet.

object of such an arrangement. The power applied at the head of a wedge, or that side of it opposite the vertex, is to the resistances opposed by its lateral faces as the area of the head to the area of the faces; consequently, in an isosceles wedge with rectangular faces, if i represent the angle at the vertex, p the pressure at the head, P the pressure at one of its faces, we have $p = 2 P \sin. i$, or $P = \frac{1}{2} p \operatorname{cosec}. i$. By diminishing the angle at the vertex we have a means for indefinitely augmenting the pressure exercised by the faces of the wedge. These results are evidently unaltered if the wedge is truncated; consequently, the adhesion at the surfaces of contact in such wheels as those described, may be made very great without augmenting the actual pressure between them, but simply by diminishing the inclinations of the surfaces of the truncated wedge in one, and of the groove in the other.

As the nature of the materials used in machinery must influence the adhesion at the surfaces of contact, some experimental illustrations of the resistance produced by the application of the wedge would be useful. From experiments made by M. Minotto on the motion of wedges of different angles and substances through grooves similarly varying in their angles and the substances of which they were made, he has drawn up a table of results, a few of which will serve to illustrate the point in question. A wedge of cast-iron with an angle of 30° , moving in a cast-iron groove with the pressure or weight 5, produced the resistance 3.75. A wedge of the same substance with an angle of 20° , and carrying the same weight, produced the resistance 5.06. Another wedge with an angle of 10° , and in all other respects similar to the last, produced the resistance 9.53. A wedge of brass, shaped as the last, and carrying the same weight, produced the resistance 10.60.

These experiments fully confirm the principle on which the wedge is to be applied in machinery. The nature of the new system of gearing is best understood by comparing it with a system of friction wheels, such as are sometimes used for the transmission of motion. Let us suppose two such wheels in the same plane, touching at their convex edges. They are in contact only on a line equal to their common thickness, and would slide over each other without any resistance, if their surfaces were totally free from friction. In order that they should be capable of transmitting force, their surfaces must not only possess a certain degree of friction, but also must adhere with a normal pressure, the direction of which necessarily passes through their centres, thus throwing a considerable pressure upon their axes and gudgeons. This pressure is evidently diminished in a system of wedge and groove wheels, for the entire pressure at the surfaces of contact may be decomposed into two—one perpendicular to the axes, the other parallel to the axes. When the angle of the wedge is small, the former must be considerably less than the latter. Thus it appears that in the wedge system a part of the injurious pressure on the axes is not only removed but utilized. A series of experiments have been made by M. Minotto on the friction and adhesion at the edges of wedge and groove wheels of different dimensions and materials, a few of the principal results of which are appended in the following table. The pressures are given in

kilogrammes, but the results are precisely the same if we suppose them changed to any other units of weight:—

Conditions of Experiment.	Pressure of one wheel on the other.	Ratio of Friction at Edges to the Pressure.	Ratio of Adherence to the Pressure.
<i>Angle of 30°, iron on iron—</i>			
Both wheels large	14.435	0.0237	0.440
Small grooved wheel with large wedge wheel,	25.534	0.0390	0.501
Do.	47.514	0.220	0.596
Small wedge wheel with large grooved wheel,	47.357	0.0255	
Do.	96.257	0.0174	
<i>Angle of 20°, iron on iron—</i>			
Both wheels large,	20.390	0.0140	0.720
Both wheels small,	40.000	0.0292	0.806
Small wedge wheel with large grooved wheel,	34.290	0.0185	0.758

From these experiments it appears that the friction is greater with small wheels than with large, and that it slightly diminishes in proportion to the increase of pressure. It deserves to be remarked, that in a combination of two wheels, one large and the other small, the friction is less when the greater one is grooved and the small one wedged than in the opposite case. From a mean of all the experiments, the adhesion with an angle of 30° for the wedge is 0.529 of the pressure, and for an angle of 20°, 0.772.

Further experiments were made to ascertain the comparative friction of two plane surfaces and two surfaces shaped in the wedge form, the results of which confirm those previously made, and the ratio of the frictions of the two kinds of surfaces underwent scarcely any change by varying the charge or pressure—a result which does not seem to have been noticed by M. Minotto himself.

To compare the friction produced by the proposed method of gearing with that of ordinary toothed wheels, M. Minotto has used the expression:—

$$f, R, \pi \left(\frac{1}{m} + \frac{1}{m'} \right)$$

f being the coefficient of friction for the substance composing the teeth; R the force exercised by the wheels on each other, π the ratio of the diameter to the circumference, m and m' the number of teeth in each wheel respectively. He gives an example of two wheels of cast-iron, one of 10, the other of 20 teeth, transmitting an effort say of 300 pounds; here $f = 0.152$, and consequently the friction of the teeth is 21.45 pounds. Two wheels on the wedge system, having to transmit the same force, would undergo an amount of friction measured by 9.081 pounds, or less than half the friction with the system of teeth. Calculation would

partly suggest the advantages of making the angle of the wedge small, not only to augment adhesion, but also to diminish the pressure and consequent friction on the axles.

Although this new system of gearing possesses great simplicity and many other important advantages, it has to contend with some practical difficulties. It is essential that the edges of the wheels should be continually pressed against each other—a condition which becomes less and less possible as they wear away—and some contrivances are required to compensate for the gradual diminution of pressure. It is proposed that the gudgeons of one of the wheels should be made movable, and capable of being screwed towards the axle of the other, or to have the grooved wheel consist of two discs, separated by a third capable of more or less compression, so that the two others could be brought together by screws as often as the wearing of the groove would require. The inventor also proposes in such cases as present a great likelihood of wear on the faces of wedge and groove, from the nature of the resistances to overcome—high velocity of motion and smallness of angle—that this effect could be obviated by indenting the edges of the wheels with two or more grooves and corresponding wedge-shaped projections. He concludes that the most suitable material for such wheels is cast-iron, next wrought iron, or one wheel of brass and the other of cast-iron. He acknowledges that the system appears at present inapplicable to bevel wheels for the transmission of motion obliquely.

Wheels on the wedge-and-groove principle have undoubtedly the advantage of being easily constructed, of being free from jars and shocks, by which so much *vis viva* is lost in ordinary arrangements, and of being capable of easy engagement or disengagement during rapid motion. But yet much of the simplicity of the system is lost by the necessity of contrivances, such as have been mentioned, for the preservation of continuous pressure between the wheels at their edges. One important application will immediately suggest itself, as it did to us long before seeing the remarks of M. Minotto, or the confirmatory observations of M. Poncelet in his report to the Institute of France*—namely, the haulage of railway trains up steep gradients. It is evident that this could be easily effected if the locomotive were provided with a wedged driving-wheel, placed centrally, which could run in a grooved rail extending the whole length of the gradient. This application would have the advantage of not requiring any contrivance for pressing the wedge into the groove, as the weight of the locomotive would do so most effectively, even for large angles of the wedge. Similar rails laid down near stations would furnish a method for stopping the train probably superior to the break now in use. Another important application is that of directly transmitting a rotatory motion to the great axles of screw steam-ships, the screws of which should revolve with considerable rapidity in order to produce a sufficient reaction on the exterior fluid. Quick motion might also be given to the driving-wheels of locomotives, without a rapid motion of the pistons, by the intermedium

* Comptes Rendus, tome xxxvii., p. 934.

of some wheels on this system between the cranks and driving-wheels. The smoothness and equability of motion which ought to accompany all the movements of properly-constructed wheels on the wedge system, suggest to us the importance of its application to clocks and chronometers, and to such astronomical and physical instruments as have hitherto been moved by the aid of toothed wheels or rack work. For such applications the angle of the wedge should be small, and every precaution taken to insure such an amount of adherence as would prevent any possibility of slipping. The facility of turning such wheels is so great, and so much is to be reasonably expected from their use, that we hope practical engineers and millwrights will soon bring the system to a final and complete test of its merits.

ART. II.—*On the Calorific Power of Turf.*

IN a very elaborate work, which has recently been published at Berlin by Dr. P. W. Brix, under the title of “Investigations on the heating power of the most important fuels of the Prussian States,”* we find some determinations of the value of turf, which may be important to some of our readers. These investigations commenced in 1848 and terminated in 1850, under the auspices of the Society for the Encouragement of Industry in Prussia, and in consequence of their expensive character were assisted by a grant from the Government. As they were carried on under the immediate direction of Professors Karsten and Schubarth, considerable reliance may be placed upon the results. The following table contains the results of the experiments upon turf.

No. 1. From Linum-Flatow, earthy turf, approaching pitchy turf; blackish brown colour; dense and heavy. 1 solid cubic foot weighed, containing 21 per cent. of water, 44·1lb.†; with 25 per cent. of water, 45·8lbs.; with 38 per cent. of water, 43·9lbs.

No. 2. From the same locality, containing much more remains of plants than the preceding, and somewhat lighter.

No. 3. From the same locality, almost entirely composed of light flow peat.

No. 4 From Büchfeld-Neulangen; colour, deep black; earthy and pitchy, and very hard and solid; 1 solid cubic foot weighed 47·75lbs.

No. 5. From same locality, very similar to the preceding, but lighter and containing more remains of plants; 1 solid cubic foot containing about 24 per cent of water, weighed 36·2lbs.

No. 6. Turf charcoal, made from turf in the neighbourhood of Hamburg; one solid cubic foot weighed 28·8lbs.

* Untersuchungen über die Heizkraft der Wichtigeren Brennstoffe des Preussischen Staats von Dr. P. W. Brix, 4to. pp. 381. Berlin, 1853.

† Prussian—100lbs. Prussian are equal to 103·3lbs. British.

Number of Peat.	Number of Experiments made.	Mean per-centage of Water.	Mean per-centage of Ash.		Unit of Comparison.	Weight in Pounds.	Available Heating Power found.—Pounds of Water raised from 32° and converted into Steam of 230° to 233° Fahr. by one pound				Quantity of Water evaporated by unit of comparison of Air-dried Fuel.
			In Air dried Peat.	In perfectly dried Peat.			Air dried Fuel			Mean of the Dried Fuel.	
							Minimum.	Maximum.	Mean.		
1	5	29.0	7.62	10.73	A Klafter of 138.4 cubic feet,	3,500	2.54	4.08	3.10	5.11	9,966
2	11	38.3	6.87	11.13	" "	2,800	2.51	3.65	2.28	5.14	7,868
3	5	27.2	6.07	8.34	" "	2,200	2.90	3.97	3.43	5.08	7,546
4	8	30.9	7.68	11.12	" "	3,300	2.52	3.36	3.14	5.00	10,362
5	4	24.5	9.33	12.36	" "	2,650	3.27	3.44	3.39	4.77	8,583
6	4	5.4	3.40	3.59	A tonne, containing 7.72 cubic ft.	125	6.43	7.24	6.68	7.10	835

According to these numbers the relative value of turf compared with coal is very much higher than has been usually assumed. Sir Robert Kane calculated upon the very imperfect data then available, that three tons of peat were equal to one ton of coal, a supposition that was considered by many at the time as far too high, and we have seen statements in which five tons of turf are considered to be equivalent to one ton of coal. It is therefore very interesting to find that, according to these experiments, which, we may remark, are the first complete ones ever made to determine the calorific power of turf, the value of that fuel, if properly consumed, is even considerably higher than the assumption of Sir Robert Kane, and that good black turf has very nearly half the value of average bituminous coals. The following are the average results of the experiments of Dr. Brix upon the Prussian coals compared with those on peat above quoted, and in order to make the data for comparison as perfect as possible, we shall add the results obtained by De la Beche and Playfair in their experiments, conducted somewhat in a similar manner, and upon an equally certain scale, upon English coals, and those of Johnson in America.

Table shewing the quantity of water in pounds which one pound of different kinds of fuel is capable of evaporating.

Minimum results of the experiments upon Prussian Coals	...	6.10lbs.
Maximum do.	...	8.93 "
Mean results for all the Prussian Coals	...	7.3 "
Minimum do. English do.	...	5.30 "
Maximum do. do.	...	8.57 "
Minimum do. American	...	5.84 "
Maximum do. do.	...	8.99 "
Minimum results of the Experiments upon Peat	...	2.34 "
Maximum do. do.	...	4.08 "
Mean do. do.	...	3.15 "

Many years ago Karl Karmarsch published the results of a series of experiments upon the heating powers of the turfs of Hanover, which, although not carried out with the same perfect arrangements as those of Dr. Brix, afford excellent comparative results, as he also determined the heating values of several varieties of wood and coal by the same means. He

classifies turf into four kinds: 1, surface, or sward or yellow turf, consisting principally of still undecomposed moss, &c.; specific gravity from 0.113 to 0.263; hence, a massive cubic foot would weigh from 7lbs. to 16½lbs.; it generally contains 1.5 per cent. of ash and rarely reaches 5 per cent. 2, Brown and black fibrous turf, in which the vegetable is still apparent, and in which roots of heath, bent grass, &c., and turfs and bark of trees frequently occur; specific gravity 0.240 to 0.676, that is, a solid cubic foot would weigh from 15 to 42½lbs.; the per-centage of ash varies from 0.5 to 14, and in exceptional cases, to 50: 3, Brown or black earthy turf, in which the vegetable structure is almost totally absent, and the mass is brittle and has a dull earthy fracture; specific gravity from 0.41 to 0.90, that is, a solid cubic foot would weigh from 25½lbs. to 56½lbs.; the per-centage of ash varies from 1.25 to 39: and 4, Dark brown or black pitch turf, which is hard and breaks into sharp angular fragments, the fracture being shining and pitch-like, and bears a sort of polish; specific gravity 0.62 to 1.03, a solid cubic foot would therefore weigh from 38¾ to 64½lbs.; the per-centage of ash varies from 1.2 to 8 per cent. The heating powers of these turfs as deduced from the experiments of Karmarsch, corrected by the data afforded by the investigations of Dr. Brix, would be as follow:—

Pounds of water raised from 32° Fahr. and converted into steam of 234½° Fahr. by one pound of fuel.

	Minimum.		Maximum.		Mean.
Surface or Sward turf	2.89lbs.	...	3.59lbs.	...	3.35lbs.
Fibrous turf	... 3.09 "	...	4.33 "	...	3.80 "
Earthy turf	... 3.13 "	...	4.29 "	...	3.69 "
Pitch turf	... 3.42 "	...	4.33 "	...	3.91 "

The mean of all these is 3.68, or exactly the half of 7.3, the mean heating power of the Prussian coals examined by Dr. Brix, and which may be considered as that of all average coals. This number is somewhat higher than the more accurately conducted experiments of Dr. Brix, but in other respects there is so remarkable a coincidence between the two series of results, that we think no doubt can exist of the accuracy of the opinion which we have just ventured to make, that the calorific power of turf is much higher than is usually assumed. The classification of turfs adopted by Karmarsch applies equally well to all our Irish turfs, with the exception perhaps that few of our turfs ever contain more than 10 per cent. of ash, and we have no doubt that the preceding numbers would very fairly represent their calorific power. In this we are borne out by the experience of many persons who consume large quantities of turf, although many of the furnaces employed bear about the same relation to a properly constructed one, that a Lancashire furnace and boiler do to a Cornish one.

A comparison between the calorific values of air-dried turf and turf perfectly dried, shows the important advantages which would be gained could we economically compress and get rid of the greater part of the moisture. For example, while the mean calorific value of air-dried turf

is 3·15, that of perfectly dried is 5·02, or more than 59 per cent. greater, or more than 68 per cent. of the average heating power of coal. It would be very desirable to have a complete investigation carried out to determine the heating powers of the different qualities of Irish turfs, similar to that made in Prussia. When we consider the immense extent of our peat bogs, and the great advantages which might be derived from their proper working, it is strange to find how few accurate data are known by which a comparative estimate could be formed of the value of turf as a fuel. We shall take the earliest opportunity of returning to this subject again, and endeavour to collect all the available information we can.

ART. III.—*On the Ramée, a new fibre adapted for Textile Manufactures.*

It is well known that the common nettle (*urtica dioica*) yields an excellent fibre of great strength and considerable fineness, but from the smallness of the plant, and still more from the small proportion in which the fibre exists in the stem, no practical application has been made of it, although ladies have sometimes exhibited their perseverance and skill by the manufacture of polka jackets and other similar articles from it. Some time since specimens of a curious kind of cloth were brought to England from China, under the very absurd name of *grass cloth*; there in Mandarin Chinese it is called *Nia-pou* (summer cloth), and *ma-pou* or *ma-cloth*, the word *ma* being apparently applied to all fibre-yielding plants. According to the most accurate information which we possess, this cloth is made from the fibres of many plants, but the finest and most superior qualities are said to be produced from a kind of nettle, the *urtica nivea*, which grows to the height of five or six feet; supposed specimens of this fibre were exhibited at the Great Exhibition of 1851, as well as of another called *Callooe Kalmoi* or *Rami*, from Assam and other parts of Eastern India, which is said to be the produce of a distinct species of Urtica, the *Urtica* or *Boehmeria tenacissima* of Roxburgh. Professor Blume of Leyden, who was formerly in the service of the Dutch East Indian Company, has brought under the notice of the public a new fibre, under the name of *Ramée*, the produce of the Islands of the Indian Archipelago, which he considers to be obtained from the *Boehmeria (urtica) utilis* (Blume). Whether this may not be the *Urtica tenacissima*, and the fibre the same as that already exhibited at London, is uncertain, but this is a point of secondary importance at present, as it would appear that the fibres of all the different species are, commercially speaking, nearly identical.

Two or three years since, by the advice of Professor Blume, the Dutch Government attempted the cultivation of this plant in the Island of Java, but with very little success, in consequence of having planted it in rice fields; the *Urtica* being a genus of plants which require shade as well as

moisture. Lately, however, the importance of this fibre has begun to be appreciated, and several trials have been made in order to bring it into use, especially in Germany, to the whole western parts of which, Holland is the the great market for tropical products. These facts, and the great probability which exists of a great deficiency of hemp occurring in a short time, has induced us to direct attention to the subject, and to give a brief statement of all the information we have been able to collect upon the subject. This is a matter of special importance to Ireland, which, as being the centre of the linen manufacture, must inevitably become that of every manufacture connected with allied fibres.

The plant which yields the *Ramée* fibre is, like the nettle, a perennial plant, and like it can be propagated by dividing the roots. Its culture is very simple, and in this respect well suited for tropical countries; the roots are only torn or cut asunder, and the pieces planted at about three to four feet apart, the soil around being previously hoed a little. If planted under suitable conditions as to shade, &c., the roots rapidly throw out their stalks, to the height of from five to seven feet. As soon as the external rind has become thoroughly brown, it is cut down for the preparation of the fibre; experience has shown that it may be cut at least four times in the year, and that the first cutting yields four stems, the second six to eight, the third ten to twelve, and the fourth sixteen to twenty; during succeeding years the produce is still greater, provided it be cut as close to the root as possible. The first cutting is usually rejected, but may be employed if cut a little earlier than the browning of the stem,

The preparation of the fibre is attended with some difficulty in consequence of the resistance of the woody part of the stem, and of a cork-like epidermis. The process followed in Borneo and Sumatra is very rude, and consists in steeping the plant in water for five or six days, and then stripping off the fibrous bark, which is dried and afterwards exposed for several days to the action of the dew, and is then subjected to a very rude hackling. This imperfect process accounts for the very coarse and inferior fibre which is usually prepared in the East Indies, and there can be no doubt that if a perfect system of steeping and a suitable hackling machine were employed, that a very beautiful fibre might be produced. It is necessary, however, to remark, that the separation of the fibre would not require the long and tedious process required for flax. When well prepared the fibre is remarkably strong, and may be bleached of a perfect white, and in this state has a remarkably beautiful silk-like lustre. It was formerly much used in the Indian Archipelago to manufacture a kind of cloth, which was remarkable for its extraordinary durability as an article of clothing; this has, however, been entirely superseded by the cheap cottons of Manchester and Glasgow. Fishing nets are still made of it, and for this purpose it would be invaluable, as it appears to resist the action of water far better than common hemp, or indeed most other fibres. So far as the experiments made in Holland and Germany upon this material go, the following facts appear to be satisfactorily established: 1, that the *Ramée* fibre is 50 per cent. stronger than flax; 2, that it is stronger than the best European hemp, and less injured by wet; 3, that it gives

less refuse than hemp; 4, that it can be spun finer than hemp, and at least as fine as the common low numbers of flax; and 5, that the *Ramée* being a perennial plant, produces more fibre than any other known fibre-producing plant. Should further experience confirm these statements great benefits will be conferred upon industry by its immediate introduction as an article of commerce.

With the exception of parts of Spain, Naples, Sicily, and parts of Greece, it is not probable that the *Ramée* plant could be successfully cultivated in Europe; but there can be no doubt that it might be grown in every tropical country. There is one region which, after its native country the East Indies, we believe to be more fitted than any other to produce it, and that is British Guiana. If it were introduced into that colony, which would be a very easy matter, it might become a great source of wealth to it, at the same time that it would afford us an excellent substitute for hemp, and its refuse an excellent material for the manufacture of paper.

[Since writing the above, we have seen a notice of a lecture delivered by Dr. Forbes Royle on "Indian Fibres fit for Textile Fabrics or for Rope and Paper Making," at one of the last meetings of the Society of Arts. As he is perhaps the best living authority upon such subjects, any remarks of his are of great importance. According to him, we have boundless resources of material, not only for paper making but for cordage, in the white-fibred plants of India; such as the bow-string hemp, the aloe, the pita-fibre, the pine-apple, and, above all, the plantain, which would rival Manila hemp or the American aloe, which bridged over broad rivers. The oakum of these plants might be converted into paper, and the fibres into fabrics of different qualities; and though they might not be fitted for making knots, they would answer for many kinds of ropes, which would be capable of bearing considerable strains. But it was important to find a substitute for Russian and Polish hemp, which we possessed not only in the hemp of the Himalaya, but in the various nettles which clothed the foot of these mountains, from Assam to the Sutlej. One of the latter, the *Rheea* fibre (in all probability the same as the *Ramée*), would not only undersell every other fibre, but in point of strength would take a position second to none of all the fibres at present imported. Some of these fibres had been made into a five-inch rope, and had been tried at Messrs. Huddart's rope manufactory, when it was found that each square inch made from the wild *rheea* bore, in the first experiment, 844 lbs.; in the second, 894 lbs.; and that from the *rheea* fibre, 910 lbs.; while the average strength of rope made with the best hemp, and after numerous experiments, from the year 1803 to 1808, was 805 lbs. per square inch. In December last some experiments were made at the East India Company's military stores with fibres in equal weights and of equal lengths. The following are the results obtained:—St. Petersburg hemp broke with a weight of 160 lbs.; Jubbulpore hemp, 190 lbs.; Wuckoonar fibre, 175 lbs.; Mudar or Yercum fibre (common over all India), 190 lbs.; China grass, 250 lbs.; *rheea* fibre, 320 lbs.; wild *rheea* from Assam, 343 lbs.; and Rote Kangra hemp, no breakage at 400 lbs. This is the fibre of the plant known as the *Cannabis Sativa*, or Indian hemp, so well known for the remarkable narcotic action of its seeds and leaves, for which purpose it is extensively cultivated in every part of India. From the statement of Dr. Royle, it appears that the East India Company had ordered twenty tons of the *rheea* fibres, as well as of the Himalayan hemp, to be annually sent from India for the purpose of having them tried. Some of the *rheea* fibres lately sent by the Court of Directors to the Manchester Commercial Association have been valued by the Messrs. Marshall, of Leeds, at from £48 to £50 per ton.]

ART. IV.—*On the method of preparing the improved Galvano-plastic Moulds of M. M. Lefevre and Thouret.*

(From *Armengaud's Publication Industrielle*, No. VIII., p. 483.)

AMONG the many products of galvano-plastic art at the Great Exhibition in London, were some prepared by a very ingenious process invented by M. Lefevre, of Paris, which excited a great deal of attention. These articles were, however, to a great extent lost as it were among the mass of others, and were not consequently examined with that care which they otherwise might have been. They have, however, found favour with the public, and now form a real article of trade.

Before we describe this process, for which the inventor has obtained patents in different countries, we shall first give a description according to Dr. Boulogne, of the methods which were previously in use to obtain impressions of medals, bas reliefs, seals, statuettes, &c., by which the most interesting works of the sculptor might be copied at the lowest price.

The first operation which the galvano-plasticker has to perform, is the preparation of the moulds, because the object to be copied is frequently of such a nature, that it would be injured by the saline solutions employed. The materials which serve for this purpose are, plaster of Paris, wax stearine, fusible metal, galvanically precipitated copper, glue, and gutta serena.

Casts in Plaster of Paris.—In order to produce plaster moulds, the medal or seal to be copied is provided with a frame of thin card paper, the height of which depends upon that of the relief of the original. A quantity of plaster, as fine as possible, is then stirred up with as much water as would be necessary to form a thick liquid. At the same time, the model is to be washed over by means of a fine and long haired pencil, with a solution of soap water; and then a first layer of plaster is to be laid on from one to two lines thick with a short badger-hair pencil. In order that the plaster may penetrate into all the intaglio parts of the pattern, it must be pressed with the pencil; thereupon the liquid plaster is poured over it until the space in the card is filled up. This done, it is gently tapped upon the table, care being taken to hold it horizontally, and this operation is repeated during several minutes, whereby all the air bubbles remaining in the cavities of the pattern, ascend and allow the gypsum to take their place. In a short time the cast will have attained sufficient consistency, and it may then be removed from the model, an operation which is considerably facilitated by the washing of soap-water above mentioned.

Casts in Wax, &c.—If wax, stearine, or a mixture of both be used for making the casts, the model is to be first heated, surrounded by a rim of card, and its surface oiled, and the melted mixture of wax and stearine poured upon it. The heating of the model is necessary, in order to prevent the congelation of the casting material, before it has filled all the interstices of the model; and the oiling, to prevent the adherence of the cast. Care must also be taken to remove any air bubbles which may

exist between the two. When it is necessary, as it is frequently, to obtain a cast from a plaster model, the operation is performed as follows:—the model is surrounded with a rim of card, or what is still better, with tin-plate or other sheet metal, and is laid on a dish, in which is put some warm water, the temperature of which is maintained by means of a spirit lamp. The plaster model absorbs the water through its under surface, with which it is in contact, and is gradually saturated with it. As soon as the moisture has penetrated to the upper surface of the plaster, the melted mixture is slowly poured upon it, the air bubbles being carefully removed from the surface by rubbing it with a pencil after the first thin layer of the melted fat has been poured on. This precaution can never be dispensed with, when it is desired to obtain a casting in wax or stearine, which will be capable of reproducing all the details of the original. Casts made altogether of wax or of stearine have certain disadvantages; the wax is too binding, and therefore contracts too much, and has too little solidity, and the stearine is brittle; it is, therefore, more convenient to employ mixtures of stearine and wax. These mixtures may be different. The following have given very good results:—

Stearine,	...	...	...	2 parts.
Wax,	...	...	...	2 "
Pulverized Graphite or Plumbago,	...	...	...	1 "

This mixture separates itself very well from the medal at the end of half an hour.

White Wax,	...	...	1 part.
White Lead,	...	...	1 "

The casts obtained with this mixture are very smooth, hard, and separate themselves perfectly from the model, when the precautions mentioned have been followed.

Impressions in Fusible Alloys.—If lead, bismuth, and tin, be melted together in certain proportions, a number of alloys may be obtained, some of which melt even under the temperature of boiling water. These alloys, which first originated with M. D'Arcet, may be employed for producing casts for galvano-plastic purposes. They have the advantage over those already mentioned, that they are good conductors of electricity, and consequently, the metallic precipitate may be thrown down upon their surfaces without any previous preparation. The most convenient alloy consists of:—

Bismuth,	...	...	8 parts.
Lead,	...	...	8 "
Tin,	...	...	3 "

These three metals are melted together in a crucible, and then poured upon a perfectly dry plate, in such a way that the alloy will be divided into drops which solidify separately. The object of this is to obtain in the re-melting as uniform a compound as possible. To employ the alloy, a quantity of the drops are melted, and the melted mass poured into a basin, in which it spreads itself into a circular surface of metal, which must be somewhat greater than the model from which the cast is to be taken. At the moment when the alloy becomes pasty before its congelation, the model is allowed to fall upon it from a height of one and a half

to two inches. The determination of this moment is very difficult; it is recognized by the change which the surface of the alloy undergoes, and which consists in its losing its lustre and becoming dull. The medal to be copied must be very cold, in order to succeed in the operation.

The object is attained much more easily by using the following process:—As soon as the alloy is fluid, it is to be poured into a shallow card box somewhat larger than the medal to be cast, and stirred with a red hot iron wire until it begins to congeal. At the moment that the medal becomes a pasty and uniform mass, the medal previously warmed is to be pressed into it, and firmly held in its position by means of a cork. The cast is only to be taken out when it has become perfectly solid, and has cooled down. In melting the alloy the greatest care must be taken that not the slightest trace of oxide be formed; hence, it ought not to be kept too long melted. If a coating of oxide is formed, it must be removed by means of a piece of card.

Impressions on Sheet Lead.—Good impressions are also obtained by the employment of rolled lead of at most the $\frac{1}{2}$ of an inch in thickness, previously washed with a solution of caustic potash to remove impurities from the surface. The piece of sheet lead is to be laid upon the medal to be copied, and upon it a sheet of moistened card paper, or still better, a number of sheets of grey paper also moistened, it is then forced into all the depressions of the medal by means of a press, or of a hammer with a large face. The galvano-plastic precipitate may itself be directly employed as a model to copy seals, medals, &c. It forms a metallic matrix upon which a new metallic precipitate may be readily deposited as a perfect fac-simile of the original.

Elastic Moulds.—The different methods just given answer very well for copying objects in low relief, but they are totally unsuited for bas-reliefs, as they are so frequently used in ornamentation, and which present such strongly projecting rounded parts, and at the same time, such sharp outlines. Even if it were possible to introduce the above-mentioned mixtures into all the intaglio parts of such ornaments, the cast could not be afterwards separated from the model without portions being broken off and left in the cavities of the mould. This is still more the case with the true *alto rilievo*, where the figures stand out considerably from the surface. Whoever has seen such objects will, undoubtedly, ask by what ingenious artifice can the galvano-plastic art re-produce all these details, as it is perfectly impossible to cast them in the ordinary way; to do this, *elastic moulds* must be invented which will fill all the entangled parts, and out of which the model can be taken without suffering the slightest injury. This problem has been solved; and in the workshops of M. Cristofle, in Paris, bas-reliefs are now prepared for silver-smiths, which would have been very expensive if cast and chiselled. The following is the process: 20 parts of glue and 2 of brown candy are dissolved in sufficient hot water to form a mixture that, when cold, will form a solid jelly; it is poured while warm upon the model, and when cold it is separated from the latter. With this elastic mould a solid one is then made by pouring the following mixture into it:

Yellow wax,	...	...	...	24 parts
Mutton fat,	...	...	...	12 "
Rosin,	...	...	...	4 "

This composition is employed luke-warm, and has considerable solidity.

In some work-shops gutta-percha has been used since some time for the same object. The moulds of this material have the advantage of being elastic under all circumstances, soft at certain temperatures, and very solid at ordinary temperatures. These gutta-percha moulds were patented in Paris, in 1851, by Mr Gueyton.

The process followed by Messrs. Lefèvre and Thouret depends upon the employment of a gelatinous substance which is insoluble in galvanic baths, and is a conductor of electricity. If we suppose that it is required to copy any particular model by the galvano-plastic process, it is first provided with a non-conducting frame, and is then covered at the points of highest relief with a number of wires or thin metallic slips, by means of which the mould, when immersed in the bath, may be placed in contact with the battery. A strong warm solution of glue is then poured over the surface to be copied, and upon which were laid the wires or metallic slips. This solution necessarily fills all the cavities of the model, and covers the points in highest relief, and also the wires or metallic slips which become imbedded in the mass. In order to preserve the mould when in the bath the back of it is covered with a coating of varnish or of some fatty substance which prevents the glue from dissolving. When the glue has solidified and the whole become cool, the frame is removed, and the mass of glue carefully removed from the model, of which it forms a perfect cast, the portions in relief of the model being in intaglio in the cast. The surface of this mould is then covered with a very fine metallic powder, in order to make it conducting.* The mould or matrix thus produced gives, with a galvanic battery, an exceedingly accurate copy of the model, even of the most delicate lines.

If this mould be dipped into a bath containing a salt of the metal to be precipitated, and placed in contact with a battery, and a corresponding anode of copper, silver, or other metal, as the case may be, be then introduced, the whole surface which contains the impression of the model, and which is near the anode, will be covered with the corresponding metal, of a thickness in proportion to the duration of the immersion in the bath. As soon as the deposit has acquired the required thickness it is removed from the bath and plunged into hot water, which dissolves the matrix, leaving a metallic cast which is an exact fac-simile of the original model. In this way the simplest, as well as the most elaborate, works of art may be imitated, and that with a great saving of time and manual labour, and with a degree of perfection not hitherto attainable. This process is consequently a considerable gain upon all those hitherto in use.

* In some cases phosphorus is now worked up with the glue; and if a matrix of this kind be washed with a solution of nitrate of silver, the phosphorus precipitates the silver in the metallic form over the whole surface, which thus becomes perfectly conducting.

ART. V.—*On the means of determining the nature of the Colouring Material employed to dye any particular fabric.*

THE most indispensable element of success in all modern manufactures, is a rigid economy of materials and of time. In chemical manufactures the former is not merely necessary to secure a profit, but also to obtain, even at any price, an article of superior quality. It is, consequently, of the greatest importance that each manufacturer should have the means of ascertaining the quality of the raw material which he employs, in order that he may use them in the proper proportions. In some manufactories this is at present done by a rough analysis, but in others the manufacturer is totally ignorant of the value of his materials. For example, not one tanner in a thousand knows the quantity of tanning material in his bark, although it may vary to the extent of from 40 to 50 per cent., or a bleacher of real effective soap in the substance which he purchases under that name. Another reason also why it is desirable to know the quality of an article is, to avoid the purchase of adulterated or spurious substances. It sometimes also happens that it would be desirable for a manufacturer to have some simple means of ascertaining the nature of a substance without the necessity of having recourse to an elaborate analysis. We purpose from time to time to supply our readers with the necessary information to effect these objects, and shall commence in the present article by a notice of the mode of determining the nature of the colouring matter with which any fabric may be dyed, and the mode of applying it.

This is an important subject, not alone to the dyer, who may wish to imitate the colours of a particular article, but also to the merchant, who often finds it of great importance to determine whether a piece of cloth be dyed with some pure expensive dye stuff, such as indigo and cochineal, or with cheap substitutes. This cannot always be done by the eye alone, and recourse must consequently be had to the aid of chemical re-agents, which produce certain characteristic reactions with each colouring matter by which it may be distinguished. Besides determining the nature of the colouring matter itself, it is also necessary, in many cases, to ascertain that of the mordant also. This is done by burning a large piece of the cloth and examining the ash, in order to determine what metallic substance has been used. As this operation requires a considerable knowledge of analytical chemistry, and a certain amount of apparatus, it may be dispensed with in the greater number of cases, as a sufficiently accurate opinion of the nature of the mordant may be formed from the reaction of the colouring matter. The methods which shall be described here are such only as may be applied with facility, and which enable an accurate judgment to be at once formed as to the nature of the colour and the mode of its employment.

Blue Colours.—These may be derived from indigo, logwood, Prussian blue, or ultramarine.

Indigo blue may be produced in various ways: 1, Ordinary indigo blue produced in the cold vat; 2, China or Fayence blue, which is a blue

pattern upon a white ground, fixed on the principle of the cold vat by lime, copperas, and orpiment; 3, the true topical blue, in which the indigo is reduced by means of protoxide of tin and potash; and 4, the blue produced with Saxon blue or indigo lake. The three first blues are not acted upon either by dilute acids or alkalies, but are destroyed by chlorine and nitric acid. If the specimen in which the colour has been destroyed by chlorine be well washed, and plunged into a decoction of Brazilwood or madder, no permanent dye will be communicated if the blue colour has been produced by either of the two first processes; while, if by the third process, or true topical blue style, it will be dyed red in consequence of the tin mordant. The blue obtained with Saxon blue or indigo lake resembles Prussian blue to the extent that both are discharged by alkaline leys; but while the indigo blue will leave a white ground, the Prussian blue will produce an iron buff, from the mordant of the metal employed in the production of the blue. In case any doubt should exist where a clear ground cannot be obtained after the discharge of the colour, a few drops of prussiate of potash, rendered slightly acid, should be dropped upon it, when, if iron be present, the blue will be reproduced. This control-test should always be used in the case of green colours. Prussian blue may be distinguished by its being discharged, as just mentioned, by alkalies, and not by chloride of lime, which acts upon indigo lake; whether it be common Prussian blue or *bleu de France* (royal blue when applied to woollens), formed by the addition of a salt of tin, may be readily ascertained by the mere appearance to the eye.

Logwood blues may at once be distinguished by their being reddened by dilute acids; this reaction is generally sufficient to determine whether the dyeing material be logwood. In the case of a blue produced by an application of logwood upon Prussian or indigo blue, the logwood is first discharged by means of some dilute acid, the sample of cloth washed to remove acid, and exposed to the action of chlorine or of caustic potash or soda, in order to determine whether the ground colour be Prussian or indigo blue. Ultramarine may be distinguished by its peculiar colour, or by the combustion of a portion of the cloth, when the unaltered pigment will be found in the ash. Muriatic acid destroys the colour of ultramarine with the evolution of sulphuretted hydrogen, which may be known by its blackening action upon paper dipped in sugar of lead, or simply by its disgusting smell. If muriatic acid does not readily act upon the colour, owing to the protection afforded by the varnish, which is sometimes used to print on ultramarine upon cloth, the varnish must be first removed by moistening the cloth with a few drops of ether.

Red Colours.—All red colours, with the exception of safflower, require the previous application of a mordant of tin or of alumina. Safflower may be readily distinguished by its being discharged by potash or soda. Madder colours when treated with muriatic acid assume a yellowish colour, passing into orange without assuming a deep scarlet tint (*ponceau*): if they be then treated with milk of lime, the colour of the parts upon which the acid had acted becomes violet, and holds for a long time, but by boiling with soap it becomes rose-coloured. The stronger the madder

colours have been brightened by soap in the "clearing process," and the higher the temperature at which it has been effected, the less sensible they are to the action of acids. This explains the great durability of Turkey red. The red and rose colour produced from madder are of different kinds: 1, the Turkey red and pink; 2, common madder red and pink; 3, true topical madder red; and 4, the colours produced with garancine. Turkey red may be readily distinguished by the brightness of its colour, and its unalterability under the influence of acids. Common madder red, when it has been somewhat brightened, is scarcely to be distinguished from true topical madder red, either in colour or durability, the only difference being the mode of production. As the topical colour is mordanted with tin before being printed, and steamed after it has been, the white produced by the discharge of the red has usually a yellowish tint, and may be dyed in a bath of peach or Brazil wood. The red and pink produced with garancine and garanceux are distinguished from the foregoing ones by this, that they do not bear being brightened with soap, and are acted upon by acids and alkalis. When treated with hydrochloric acid they become orange, and do not then become violet if treated with milk of lime as madder red, but assume a dull blue colour. Certain peculiar shades of colour indicate whether garancine or garanceux have been employed; the latter colouring material producing colours having an orange tint. If the red is accompanied by a violet the distinction can be much more easily made, because garancine yields a violet which is almost as beautiful as that from madder, whilst that from garanceux is more of a reddish grey.

The red colours obtained from logwood, peachwood, &c., and cochineal, change into a gooseberry red if treated with hydrochloric acid and salt of tin. If they be then treated with milk of lime a fugitive violet is obtained, which by subsequent boiling with soap entirely fades, whilst madder colours would thus attain their greatest brilliancy. The red of cochineal may be distinguished from the colours produced by the dyewoods just mentioned by its peculiar shade and by its behaviour towards sulphuric acid; under the influence of this re-agent the former becomes bright cherry red, and the colours of the dyewoods orange.

Yellow Colours.—The yellow of quercitron bark is discharged by chlorine and bleaching powder, but is not sensibly changed to orange either by potash or salt of tin. The yellow of Persian berries is also discharged by chlorine; a solution of potash changes it into a rich yellow. Heated with salt of tin, it passes into orange; and when treated with sulphuric acid it becomes a stone colour. Orange and nankin colours from fustic are changed into red by the action of sulphuric acid; potash gives them a catechu-like colour, and nitric acid discharges them. Yellow from sumac assumes a brighter colour with salt of tin; it is reddened by nitric acid, and but little altered, however, by sulphuric acid; copperas converts it into a grey colour. The yellow and orange from anatto are difficultly attacked by chlorine; concentrated sulphuric acid makes it blueish green for a moment before it chars the cloth; it becomes first darker coloured and then completely disappears from the action of nitric acid. Chrome yellow is not altered by heat and dilute hydrochloric acid, but is destroyed by concen-

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trated acid. Canstic potash decomposes it, and boiling lime-water changes it into orange. Chrome orange becomes greenish yellow with acids.

Black Colour.—Logwood black is produced with an iron mordant, and sometimes with an iron and alum one. In the latter case it may be distinguished by a tinge of blue. Such a black is discharged by chlorine, but the ground becomes iron buff from the iron mordant. It is reddened by hydrochloric acid and salt of tin: by the former mode a cherry red is produced, and by the latter a violet red. Black produced by astringent substances have always a kind of olive tint. Treated with hydrochloric acid it assumes a pale ashy kind of orange colour; treated with salt of tin the iron is dissolved out, and the colour passes into a dirty olive. Chrome black is very easily distinguished by its behaviour towards chlorine; while all other kinds of black are discharged by that re-agent, chrome black merely assumes a chestnut brown shade.

With mixed colours the examination is more complicated. But as the greater number of them are formed from combinations of the above-mentioned substances, the preceding observations will enable the constituents of these also to be determined, and the mode in which the colours have been produced.—*Chiefly from the Deutsche Musterzeitung.*

ART. VI.—Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.

MINING, METALLURGY, ETC.

On the employment of Water in filling up deep Bore Holes in Blasting Operations.—In working the great deposit of magnetic iron ore, which occurs under peculiar circumstances, in the granite at Moravitz in the Banat, it has been found necessary, in consequence of the hardness of the rock and ore, to use bore holes from 2 to 24 inches in diameter, and 36 to 40 inches deep. The packing of such holes with clay being a very tedious operation, Mr. A. Keszt endeavoured to substitute water for the clay with considerable success. One of Bickford's safety fuses, which burns in water perfectly, is attached to the cartridge and fastened with thread; this cartridge is let down to the bottom of the hole, and about 1½ to 2 inches of clay firmly packed over it, the remainder of the bore, to nearly the top, being filled with water. In the case of very oblique bores, where the pressure of the water upon the bottom was small, he plugged up the orifice of the bore with a plug of wood, driven with considerable force into it, through a slit in which the fuse passed. More recently, still, he has used instead of the small quantity of clay at first introduced, to keep the cartridge from being wetted by the water, a mixture of tar and pitch, which most effectually preserves the powder from damp. Great numbers of trials have convinced him that the blasts fired with this arrangement lose nothing in force, whilst there is a very great saving of time and consequently of expense.—*Oesterr. Zeitschrift für Berg-u-Hüttenwesen*, 1853. No. 13.

Gas Puddling Furnace at Ilseburg in the Hartz.—For several months past a gas puddling furnace, on the principle of Thomas's, has been at work at this celebrated smelting works. The gas is produced from wood, turf, brown coal, but especially from the cones of the pine trees. The bar iron produced by these fur-

naces is of the first quality, and can be produced 36s. per ton cheaper than by the ordinary process. More recently still, a furnace has been erected at Mandelholz, near Rothehütte in Hanover, fired by gases obtained from turf alone, and is proving very successful.—*Berg. und Hüttenm. Zeitung*, 1854, No. 2.

Method of communicating a dull Black Colour to Brass.—According to M. Leykauf, a dull black colour, such as is frequently employed for optical instruments, may be given to brass, by first carefully rubbing the object with tripoli, then washing it with a very dilute solution of a mixture of one part of neutral nitrate of tin and two parts of chloride of gold, and then wiping off the excess of liquid, after the lapse of ten minutes, with a wet cloth. If there has been no excess of acid, the surface of the metal will have assumed a dull black colour. The neutral nitrate of tin may be prepared by decomposing the perchloride with ammonia, and dissolving the precipitated oxide thus obtained in nitric acid.—*Le Technologiste*.

M. Gaudin's method of causing depositions of all kinds of Metals upon any Metal whatever, by immersion in a Liquid or by a current of Electricity.—Hitherto the solutions employed in depositing one metal upon another by electrical agency have been made with one or more salts of the metal to be deposited, the strength of the solution being subsequently maintained by the gradual dissolution of *anodes* of the same metal placed in the bath. M. Gaudin proposes to form his precipitating bath without the use of any metallic salts, except those produced by the dissolution of the anode alone. For this purpose he makes a saturated solution of common salt, with the aid of heat, allows it to cool, filters it, and then adds 1-200th of its weight of oil of vitriol, allows it to repose for 24 hours, and then filters it again. Into the solution thus constituted an anode of the metal to be precipitated is plunged, and in two hours it will be ready to give a deposit of metal by connecting it with a battery. Thus, to produce a bath that will yield a deposition of silver by simple immersion, it is only necessary to dissolve part of a small piece of silver in it, and to allow the remainder to lie in it, and in 24 hours the bath is ready. He considers such a bath to be adapted to the deposition of gold, silver, tin, copper, iron, zinc, platina, &c. There is nothing very new in this process, still, if it should be found to answer, it would be more economical than forming the solutions in the first instance with expensive salts.—*Armengaud's Publication Industrielle*, tome 8, p. 93.

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

M. Terwagne's Hemp and Flax Brake.—The ordinary brakes, even of the best construction, only yield a broken, but not a properly bruised flax, and instead of losing a large part of the 75 per cent. of shives or woody part which dry retted flax contains, only separate about 10 per cent. M. Terwagne has invented a kind of brake, which is stated to separate 50 per cent. of the shives. This machine consists of a grooved table, from 2 to 5 metres ($6\frac{1}{2}$ to $16\frac{1}{2}$ feet) long, according as the motion is to be given by hand or by power; and 90 centimetres (3 feet nearly) wide; a width of 75 centimetres ($29\frac{1}{2}$ inches) being grooved. This table may be of wood for flax, but must be of iron for hemp. Upon this table a sort of box, composed of cast-iron plates, and weighing, according to the length of the table, from 450 lbs. to about 1 ton, rolls upon two, four, or six rollers, which fit accurately into the grooves of the table—the backward and forward motion being communicated by a simple mechanism of toothed wheels and cranks. The flax to be bruised is spread upon the whole length of the table in regular layers, 2 centimetres ($0\cdot78$ of an inch) thick; in this position it is kept confined by means of a number of cords stretched across the table at equal distances. One end of these cords is attached to a rod of wood, and the other to a weight, which keeps it tightly stretched. Ten cords are usually attached to each rod, so that by lifting a rod with a fork whenever the flax is to be removed, 10 of the strings can be removed together. By the repeated rolling of the heavy box, which may be weighted if necessary, somewhat like an ordinary mangle, the woody part is effectually broken and the fibres opened out, at the same time that they remain parallel. The latter point is of great importance, as there is less loss in the sub-

sequent scutching; the points of the flax, too, remain in their natural condition, whilst, when the flax is badly or imperfectly bruised, they are liable to be lost in the scutching.—*Armengaud's Génie Industriel.*

On the different methods proposed to prevent the incrustation of Boilers, by Dr. L. Elsner.—It is well known that sawdust has been often proposed to prevent the incrustation of boilers. Board recommended the sawdust of mahogany; according to Hill, that of oak acts very well. It would thus appear that it is not absolutely necessary to employ the sawdust of mahogany, but that that of other woods would produce the same results. The experience of the author confirms this supposition; for water containing a considerable quantity of gypsum, and which formed, when boiled for some time, a considerable calcareous deposition on the sides of the vessel, ceased to do so when boiled with the sawdust of different woods, even with that of common deal. It formed rather a thick mucilaginous liquid, which was easily removed from the boiler, and left the sides free from all incrustation. Ritterbrandt recommended the addition of sal-ammoniac, not only to prevent the formation of incrustation, but to dissolve off any that may have formed; the action of this substance depending upon the mutual decomposition of the carbonate and sulphate of lime in the water of the boiler and the sal-ammoniac with the production of carbonate and sulphate of ammonia, which are very soluble, and the still more soluble chloride of calcium. The author fully confirmed the experiments of Ritterbrandt by the results of some trials which he made with sal-ammoniac upon well water abounding in gypsum. A very small quantity of that salt added to the water prevented all incrustation, and completely dissolved that which had previously formed. As, however, the quantity of gypsum and carbonate of lime in the water used for feeding boilers varies in different localities, the same quantity of sal-ammoniac is not always required to be added to the water. As a general rule, however, we may add a quantity equal to the whole of the solid matter contained in the feed-water, which may easily be determined by evaporating a gallon of the water and weighing the residue and multiplying it by the number of gallons thrown into the boiler by the feed-pipe during a given time. In all cases, however, 1 part of sal-ammoniac to 1200 parts of water will be sufficient to prevent incrustations, or, what is the same thing, 1 lb. of sal-ammoniac to 20 cubic feet of water, and in many, 1 lb. to 50 cubic feet, would be sufficient. The great objection to the use of sal-ammoniac is, that if the water contains carbonate of lime, which it invariably does where incrustations are formed, carbonate of ammonia will pass over in the steam, which cannot be used for many purposes; whilst the copper tubings and brass fittings are rapidly corroded.

The author also obtained satisfactory results by the use of tanning materials. These substances produce a brown mud-like deposit, which does not adhere to the boiler, and can be readily removed. This mud consists of a combination of lime with tannic acid, and a brown colouring material. Among the tanning materials he recommends catechu, oak-bark, tormentilla, and several other wild plants; in all cases it is better to use the decoctions of these substances, as otherwise they would be open to the same objection as saw-dust, which is liable to get into the cocks, valves, &c. The author has also confirmed the observations of Guinon, that saccharine substances, such as molasses, glucose, &c., effectually prevent incrustations. These substances produce a mucilaginous brown precipitate, not at all adhesive, and capable of being removed with great facility.

Some years ago Kuhlmann proposed the use of carbonate of soda, which has again been recently recommended by Fresenius, and notwithstanding the objections which have been raised against its use, Dr. Elsner finds that it acts perfectly. When, however, too large a quantity is employed it acts upon all the joints, cocks, lutings, &c., and destroys them in a short time; and to this cause alone he attributes the objections which have been made against its employment. If the proper proportion be employed, which may easily be ascertained in the way already indicated, no such injurious action need be feared. The same objection applies to caustic soda, which has been proposed by Dam, and which possesses no advantage whatsoever over the carbonate. Dr. Elsner further remarks, that the boilers are never so clean with carbonate of soda as with sal-ammoniac, which, apart the disadvantages attending its use above mentioned, is undoubtedly the

most effectual remedy against incrustations.—*Polytechnisches Centralblatt*, No. 4, Febr., 1854.

Friction co-efficient between Clay and Iron.—Doppler has determined by experiments upon horizontal and inclined planes the co-efficient of friction between iron and clay, a point of great importance in connexion with agricultural implements, &c. For an argillaceous clay, containing 13 per cent. of water in its dry state, and 45 per cent. of clay, it was found to be 0.5 as a mean, and 0.55 as a maximum; for a soil containing 6.6 per cent. of water, and 18 per cent. of clay, the minimum was 0.38. These experiments were made with a perfectly clean iron plate. Rust increases the friction to 0.56; rubbing with oil diminishes it to 0.27, and it then remained even after having been worked for a considerable time and cleaned, at 0.31. The value formerly assigned in most books, 0.197, Doppler thinks could only have been introduced by an error of the press.—*Berichte der Wiener Akademie*, Bd. 8, s. 457.

IMPROVEMENTS IN THE MANUFACTURE OF TEXTILE FABRICS.

New mode of producing Gold Thread.—Several attempts have been made to gild fine fabrics, such as muslin, by moistening them with neutral chloride of gold, and then exposing them to a stream of hydrogen gas which reduced the gold to the metallic state. This process did not, however, yield good results, and was soon relinquished. According to Barreswil, M. de Pouilly now prepares gilded silk yarn by first coating the threads with copper and then electro-gilding them. The details of his process are still secret, but the idea deserves attention.—*Bulletin de la Soc. d'Encour.*, Sep., 1853, p. 541.

Method of covering Woven Tissues, Paper, &c., with Metallic Powders, &c., by Duval, of Paris.—In order to procure metallic tin as a fine powder, chloride of tin is to be dissolved in water containing a little hydrochloric acid, and slips of zinc placed in it. The tin is gradually precipitated at the same time that the zinc dissolves; the precipitated tin is washed perfectly, a little acetic acid or nitric acid being added to the last portions of water used. In certain cases a small quantity of proto-nitrate of mercury or nitrate of silver may be added to the tin precipitate after it has been washed, in order to communicate to it a silver-like appearance. The more dilute the solution of tin, the finer divided is the precipitate of metallic tin. This tin powder is put upon woven tissues or paper by mixing it with gum arabic or glue. Or by impregnating the paper or the tissue with the tin salt, and then laying it upon a zinc plate, the precipitation of the metallic tin will take place directly in the substance of the cloth and paper. Salts of silver, platinum, bismuth, antimony, lead, gold, copper, &c., may be used for metallizing according to either of these processes.

Silver is reduced from the nitrate by a concentrated decoction or extract of logwood. The paper or tissue is washed with a very dilute solution of the nitrate, and is then placed in contact with a plate covered with the logwood extract, or with a piece of cotton cloth saturated with it. For economy sake the paper to be silvered is usually coated with a spirit or an oil varnish. The paper or cloth may also be prepared with the extract first, and then washed with the salt of silver. If the paper be now dried in an atmosphere containing some ammonia, the silver is reduced, and may be burnished. Wood, bone, ivory, and leather can be silvered if they are allowed to soak for a quarter of an hour in a decoction of logwood at the temperature of 176° Fahrenheit, then removed, wiped, and laid for ten minutes in a solution of nitrate of silver, and the operation repeated if necessary. If it is desirable to use the silver as a powder, the sulphate of silver is the best salt to employ; this may be reduced by zinc or copper. Dark or light coloured brass may be obtained in a sufficiently divided state, by taking a cylinder of the proper metal and fixing it as an axle over a wooden box, and causing it to revolve rapidly in contact with a file which is kept pressed against it by means of a spring or a weight. The filings thus rapidly produced may be still further divided by grinding them upon a smoothly polished plate of glass with a muller of glass or of the same metal as the filings. A small mill might also be employed for the same purpose, the base being glass and the runner brass. In this way the metal may be reduced to the most impalpable powder. In order to coat paper, wood,

or tissues with this powder, it is to be mixed with gum or glue, and then employed exactly as colours are usually in the manufacture of ornamental papers. The gum, or glue, or varnish, can also be printed upon the substance to be coated, and the metallic powder then dusted on. To produce a gilded surface, the object is rubbed over with a varnish, and then with chloride of gold, after which it is placed in contact with a cloth moistened with a solution of green copperas. The coating of gold thereby produced is then burnished, and will exhibit a perfectly uniform coating of gold. This, or a similar process, is also applicable to wood, leather, ivory, horn, &c. The chloride of gold may also be reduced by sprinkling the surface moistened with the salt with zinc or copper powder; other metals may also be precipitated in this way upon ivory, horn, &c. We would recommend these processes to those interested in the manufacture of ornamental paper, and ornaments in general, as applicable to a great many useful purposes.—*Le Génie Industriel*, Jan. 1854, p. 24—26.

IMPROVEMENTS AND INVENTIONS CONNECTED WITH CHEMICAL PROCESSES.

Preparation of Copal Varnish.—The solution of copal in fat or volatile oils is easily effected, if previously melted, but the copal acquires thereby more or less colour, and loses considerably of its natural hardness. Various attempts have accordingly been made to dissolve it without previous fusion, which, as all know who have occupied themselves with the preparation of varnishes, is attended with considerable difficulties. Some have recommended soaking the powdered copal in ether or ammonia until it swells up and becomes gelatinous, and then dissolving it in strong spirit of wine, a process which Dr. Heeren never succeeded with. Others have proposed tying up the copal in a small bag, and suspending it in a retort in which absolute alcohol is kept gently boiling; but with this process he was also unsuccessful in preparing a concentrated varnish. In his opinion, the following formula proposed by Frendenvoll,* is the best:—4 oz. of West Indian copal, dissolved in 4 oz. of oil of turpentine, and 6 oz. of spirit of wine; or in a mixture, 4 oz. of ether, 4 oz. of oil of turpentine, and 4 oz. of spirit of wine. Whilst occupied with this process, which had already yielded him some very good results, Dr. Heeren found that a slight modification might be made with considerable advantage. Two kinds of copal come into commerce, the East and West Indian. The former generally consists of irregular rounded pieces, with a fine warty surface, not unlike that of the skin of a plucked goose. It is somewhat yellowish coloured, and is preferred for the preparation of oil varnishes, as it does not become so highly coloured by melting as the West Indian. The latter has not the same warty surface, is of a very pale colour, and very often almost perfectly colourless, and occurs in large irregular broken fragments, partly with rounded surfaces, and partly with surfaces exhibiting a conchoidal fracture.

It is only the West Indian which can be dissolved in the following solvent, as the East Indian would simply give gelatinous lumps, and not a solution. The solvent is, 60 parts by weight of spirit of wine of Sp. G. 0.831, 10 parts of ether, and 40 parts of spirit of turpentine, in which must be dissolved 60 parts of copal, in order to produce a varnish of the consistence of oil. The dissolution is produced without the copal previously swelling up into a gelatinous mass, even in the cold, but much quicker with the aid of a gentle heat. As, however, pieces occur in West Indian copal which do not dissolve, but become gelatinous, and destroy the rest of the solution, it is advisable to select only the largest and clearest pieces, and to subject each to a previous test of its solubility. The slight trouble bestowed upon this operation is richly rewarded by the certainty of the results obtained. In order to make this test, a small fragment of each piece is to be heated separately in a small glass test tube, with a few drops of the solvent. If the copal dissolves completely in a short time, that is, in some minutes, and without gelatinizing, it is good. When a sufficient quantity of copal has been selected in this way, it is to be reduced to a moderately fine powder; this is then

* Praktische Erfahrungen über die gesammte Firnissfabrication, Von D. und F. Frendenvoll, 2 Aufl. Maintz, 1846. Practical Experiments on the manufacture of Varnishes generally, &c.

introduced into a flask, and the necessary quantity of the solvent above described poured upon it, and the flask heated with frequent agitation, until the whole has dissolved. If the varnish should appear turbid from dust or other impurities, it may either be laid aside until they have deposited, or it may be filtered through paper, the filter being made smaller than the funnel, in order that the latter may be covered with a glass plate, to prevent the evaporation of the spirit. The filtration through paper is undoubtedly a slow operation, but the varnish is obtained thereby perfectly clear, and if the copal was well selected, almost absolutely colourless; it dries readily, but of course, like all turpentine varnishes, surfaces coated with it retain a soft adhesive feel for several days.—*Dr. Heeren, in Mittheilungen des Gewerbevereins für das Königr. Hannover, 1853, p. 196.*

Composition of Soaps used in the different Manufactures, by F. C. Calvert, of Manchester.—It is well known that the composition of the soaps used in scouring silk, washing wool, and brightening madder colours, are quite different, but hitherto the public was not acquainted with their composition, or with the true proportions in which the ingredients of such soaps should be combined in order to give their maximum effects. Mr. Calvert made a number of analyses with this view, and found that the soaps used for the same purpose, often varied in their quality in the most remarkable degree; nevertheless he found that, taken as a whole, the composition of the different varieties of soap used for the purposes above mentioned, exhibited a certain relation with one another, and that the average composition of each class of soaps differed considerably from that of the other. These differences are represented in the following table, in which the mere results of his analyses are calculated upon the supposition of each soap containing 30 per cent. of water—that element being variable, according to the age of the soap, as well as from other considerations, is of no importance in estimating the composition of a soap so far as the author's objects were concerned; the point to which he directed his attention being the relation between the alkaline and the fatty matter.

	Calico Printer's Soap.	Silk Dyer's Soap.	Soap for Wool Washing.
Fat . . .	64.0 . . .	61.9 . . .	61.4
Soda . . .	6.0 . . .	8.1 . . .	8.6
Water . . .	30.0 . . .	30.0 . . .	30.0

From this table it results that, taken as a whole, the alkaline element of soap varies according to the use for which it is intended. That employed for scouring silk, contains as a mass 2.1 per cent. more alkali than that for brightening madder colours. Hence it is of the greatest importance for manufacturers to examine the soap which they employ, because, for example, if a calico-printer were to use a wool soap, he might injure the tints of his colours, whilst the use of the neutral soap of the calico-printer would not produce the same effect in washing wool as an alkaline one, as the latter would be better adapted for removing the fat of the yolk. There is another point worthy the attention of the calico-printer, namely, that the soap which would answer for madder reds, and pinks, would not answer for madder purples, for which a soap with the minimum quantity of alkali seems to be best adapted. The following table represents the compositions of the soaps which seemed best adapted for this purpose:

	Soap for Madder Purple.	Soap for Dark Madder Rosa.
Fat . . .	60.4 . . .	59.23
Soda . . .	5.6 . . .	6.77
Water . . .	34.0 . . .	34.00

Nevertheless the calico-printer uses the same soap for all colours.

Mr. Calvert examined samples of soaps sent out from the same factory in the course of the year, and apparently sold as the same article, and for the same purpose, and found that the percentage of water varied from 26 to 45; that of the alkalis from 5.8 to 7.5; and that of fat from 46 to 66. Hence the importance of the merchant examining the composition of each new parcel of soap received, otherwise he will never be able to arrive at the same definite results.

Mr. Calvert also states that soap made with the oleic acid, resulting from the manufacture of stearic acid by the lime process, is not so well adapted for the calico printer as that made with fat and oils in the ordinary way.—*Chemical Gazette, March 15th, 1853.*

DYEING AND THE PREPARATION OF COLOURS.

On a Red or Violet Colouring Material produced from Sulphate of Indigo, by Ch. Gros Renaud, Junr.—If indigo lake be stirred up with water, so as to produce a dark blue liquid, and a caustic soda ley, marking 38° of the aerometer, be added, a dark, appearing almost black, precipitate will be formed, and will remain suspended in the liquid, which will have assumed a yellow colour. If this fluid be separated from the precipitate, and mixed with excess of sulphuric acid of 66° after a couple of hours, it will again become blue. If, however, it be left standing for 24 hours, and then mixed with the acid, it will assume a green colour; and after standing for 40 to 48 hours, and the addition of a strong excess of acid, an intense red will be obtained after the liquid has assumed various intermediate shades. If the fluid be allowed to stand for about eight days before the addition of the acid, the red colour produced will be brownish; the same result will take place if heat be employed in order to hasten the production of the red colour. If wool or woollen cloth be dipped in the red liquor after it has been diluted with water, and the acid partially neutralized with water, it will be dyed of a lighter or darker shade, from rose coloured to amaranthus, according as the bath is more or less concentrated, and the temperature higher or lower. If a bath of liquor be employed which has only stood 24 hours before the addition of the acid, violet colours will be obtained.—*Bulletin de la Société Industrielle de Mulhouse, June, 1853.*

On the preparation of a Colouring Matter from Madder Flowers by means of Wood Spirit.—In the year 1851, MM. Julian and Roquer, of Sorgues, in the department of Vaucluse, introduced into commerce a preparation of madder, under the name of madder flowers, which met with an extensive sale, 300,000 kilogrammes (300 tons) having been sold during the year 1852. This substance is prepared by stirring up ground madder in large cisterns, with cold or warm water, in which any lime present has been neutralized by some acid. The mass thus treated is allowed to flow into a filtering vat; here it is allowed to remain from one to five or six days, according to the colours intended to be produced, and according as it is intended to induce a vinous fermentation. After the vat has drained, the pasty mass is pressed in a hydraulic press, and the pressed cakes dried in a stove, ground and packed for sale. Madder flowers are decidedly superior to madder, especially in giving purer and more beautiful tints than ordinary madder, at the same time that they are equally solid. This superiority is owing to the removal of sugar mucilage, acids, &c., which, by uniting with the mordants, would injure the violet tints.

If madder flowers be treated with boiling wood spirit, and the mass filtered, and a certain quantity of distilled water added to the filtered liquid, an abundant yellow precipitate is thrown down, which may be collected on a filter and washed with distilled water. Messrs. Gerber and Dollfus, who obtained this substance, term it *azale*, from *azala*, an Arabic name for madder, (probably it is nothing more than alizarine). It is a shining powder of a bright yellowish-brown colour, and has the same effect, as a dyeing material, as 40 times its weight of madder. One litre of water dissolves only about 1 centigramme of *azale*; the solution has a slightly yellowish colour, which becomes brownish, and finally rose red, on passing a stream of oxygen gas through it. *Azale* in suspension in water also becomes at first brownish on exposure to the air, and then yields a red solution, which is rendered yellow by acids, and purplish violet by alkalies. Wood spirit (rectified and still retaining a slight yellowish tinge) exerts a far greater solvent power upon the colouring matter than spirit of wine. Messrs. Gerber and Dollfus obtained from 100 parts of madder flowers 6.75 parts of dry extract, having the colour of yellow catechu, somewhat brittle, but when gently warmed, soft. When the partially exhausted residue was again heated with boiling wood spirit, to which 10 grammes of sulphuric acid per litre of spirit were added, a further quantity of extract, somewhat softer than the first, amounting to 6.65 parts, was obtained. The residue was then completely exhausted of all colouring matter. The madder extract prepared with wood spirit has $12\frac{1}{2}$ times the dyeing action of the same weight of madder flowers; so that the 13.4 parts of extract obtained from 100 parts of madder flowers ought to produce the same effect as 167.5 of that substance, (13.4×12.5)! It would appear from this that a

considerable part of the colouring matter of the madder is inactive in a bath prepared by a simple decoction of madder, for 100 lbs. treated with wood spirit are equal to 167·5 used in the ordinary way.

In the experiments instituted to test the dyeing powers of the wood spirit extract, it was first suspended in a few drops of wood spirit or alcohol, previous to adding it to the water, a proceeding which is unnecessary if the pure colouring matter, azale, be employed. About 15 per cent. of the weight of the extract, of chalk was added, to neutralize free acid, which they consider to be formic acid, derived from the wood spirit. None of the precautions which must be adopted in dyeing with the ordinary madder-bath are necessary in using the extract. The temperature of the bath may be raised or lowered without influencing the quality of the dye; and if the bath be not exhausted it may be subsequently employed a second and third time, until the colouring matter is fully exhausted. The extract, well divided and suspended in water, strongly dyes mordanted cotton after a few hours' contact, at the ordinary temperature. The colours communicated in this way, when dipped for a few minutes in warm water, withstand the action of soap and other finishing operations perfectly. The dyes produced with madder extract are in general more beautiful and solid than those obtained with madder or any of its products hitherto discovered. This is especially the case with the violet, which is always the first produced. If the quantity of the colouring matter is small, compared with that of the mordants, the whole of it will combine with the iron mordant, producing violet, and none with alumina mordants. It would appear that the purer the colouring matter the greater will its affinity for the iron mordant exceed that for the alumina one.

Azale may be sublimed, and then forms long needles of an orange-red colour. If mordanted cotton be introduced into water containing azale in suspension, it is rapidly dyed, even when the temperature does not exceed 86° Fahr. The violets thus produced is very bright, and much more beautiful than that obtained in the ordinary way. The brown and black are perfect; the reds and pinks, although beautiful and vivid, are not quite equal to the same colours when washed with soap and water, &c. The unmordanted ground remains perfectly uncoloured, which is a great advantage. All colours produced by it perfectly withstand washing in soap-water, and the application of alterants; the violets are not in the slightest degree changed by these processes, whilst the reds and pinks assume the most beautiful shades that can be desired.—*Memoire sur la Garance, par J. Gerber and Ch. Dollfus; Bulletin de la Société Industrielle de Mulhouse.*

Employment of Buckwheat Straw as a substitute for Quercitron Bark.—According to a communication of Dr. W. H. Von Kurrer, the straw of buckwheat is employed since 1852 in many establishments in Russia for the dyeing of cotton yarns and fabrics, as a substitute for quercitron bark.—*Polytechn. Journal, Bd. 129, s. 293.*

Cheap substitute for Damp Blue.—Mr. Grüne proposes to substitute sulphuric acid for the expensive tartaric acid, in the preparation of damp blue. For this purpose great exactness should be observed in the proportions of acid and salt, as an excess of the former would injure the cloth; the proper proportions would be, 1 lb. of prussiate of potash, and 222 grains of oil of vitrol, mixed with from $\frac{1}{2}$ to 1 quart of water. The prussiate should not be powdered, but introduced in pieces about the size of a nut into the cold dilute acid, and stirred about until complete decomposition has ensued, which takes place very rapidly. A white sediment of fine crystallized sulphate of potash is deposited, and a clear greenish-yellow solution formed, which, with the addition of boiled starch or dextrine, and the necessary quantity of ferro-cyanide of tin, may be employed for printing, &c.—*Ibid.*

Mode of using Bi-sulphate of Soda as a substitute for Cream of Tartar and Alum.—The use of this substitute in the dyeing of woollen goods is becoming more general every day, in consequence of the saving of nearly 100 per cent. effected by it. The colours in the preparations of which it has hitherto been employed are chrome-black, chrome-brown, grey, all fancy colours, green, carmine, blue. A decoction made in 4 lbs. of the bi-sulphate has the same effect as 4 lbs. of alum and 2 lbs. of tartar; in the dyeing of some colours some alum is,

however, still employed. For every 50lbs. of wool to be dyed of a chrome-black, 1lb. of chromate of potash, and $\frac{1}{2}$ lb. of the substitute are required. The wool is to be introduced at a temperature of 190° Fahr., then boiled for 50 minutes, and dyed in a fresh bath of Brazil wood, containing, according to the shade, $\frac{1}{4}$ to $\frac{1}{2}$ lb. of the dye-wood. To dye the same quantity of wool of a chrome-brown, 1lb. of chromate of potash, $1\frac{1}{2}$ lb. of substitute, and $\frac{1}{2}$ lb. of alum are employed. The wool is boiled for one hour, and then dyed in a bath of logwood; or for a yellowish brown and bronze shade, in a bath composed of fustic, Brazil wood and logwood in certain proportions. In the dyeing of green some add alum to the substitute, and throw the substitute, in the proportion of $\frac{1}{2}$ lb. to 10lbs. of wool, directly into the dye bath, omitting altogether the previous boiling.—*Deutsche Musterzeitung*, No. 6, 1853.

On the Staining of Horn, especially Horn Combs, Black, by Professor Rudolph Wagner.—Comb-makers are in the habit of staining the lighter coloured and spotted combs black, in order to make them resemble those made from the buffalo horn. Hitherto a sort of magma, composed of milk of lime, washing soda, and red lead, has been used for this purpose. When the whole mass of the comb is to be dyed it is laid in this mixture; but when it is to be merely spotted black in imitation of tortoise-shell, it is rubbed upon the parts to be stained. After removal from the dyeing liquor, they are washed with water, to which a little vinegar is sometimes added, dried, and then polished. By this treatment the combs assume a fine black colour. This process is founded upon the decomposition of a small portion of the horn substance and the formation of sulphurets of sodium, with part of the sulphur which exists in combination with the organic matter of the horn. This sulphuret of sodium is decomposed as fast as formed by a portion of the oxide of lead dissolved by the lime water, or by the soda, and black sulphuret of lead is formed, which stains the comb. This process gives, in general, very satisfactory results, and recommends itself by its great cheapness. It is, however, attended with two disadvantages, one of which is, that the action of the lime upon the comb causes it to warp, especially the teeth; the other and more important is, that if the combs are kept in a damp place, especially if shipped on board vessels, the sulphuret of lead gradually oxidizes, and produces sulphate of lead, which gives rise to white spots or stains, and destroys the appearance of the article. In order to remedy these defects, Professor Wagner proposes to use a salt of mercury. But as oxide of mercury does not appear to combine with lime, it cannot be used in the same way as oxide of lead. The process he recommends is to dissolve 4 oz. of mercury in 4 oz. of concentrated nitric acid, and to dilute the mixture with 16 oz. of water; in this solution the combs are to be steeped for a night. The solution is then to be poured off, the combs washed with a little water, which may be added to the solution poured off, and then repeatedly washed with fresh water, until it ceases to react acid. By this treatment the combs assume a reddish tint, or a fine brown, if the mercurial solution be used in a concentrated state, and might therefore be employed directly to produce imitation tortoise-shell. The combs thus stained red are to be introduced into a solution composed of $\frac{1}{2}$ oz. of sulphuret of potassium (of the apothecaries) in 2 lbs. of water, and allowed to remain in it from 1 to 2 hours. The blackened combs are first washed with water, then with water to which a little vinegar has been added, and finally with pure water, and polished. Although the staining thus produced is exceedingly perfect and durable, it does not penetrate very deeply, and care must therefore be taken in the polishing. From the exceedingly small quantity of the solution of nitrate of mercury which suffices to stain the horn red, it does not cost more to use it than the mixture of lime, soda, and lead.—*Polytechnisches Journal*, B. cxxx. Heft 6. S. 420.

French method of communicating a beautiful Red Colour to Horn, by A. Lindner.—The process employed in France to stain horn in imitation of tortoise-shell, by which a fiery red colour is produced which is exceedingly agreeable by transmitted light, is quite different from the old method with lime, soda, and red lead, and from that recommended by Prof. Wagner, just mentioned. The horn is first prepared by soaking in dilute nitric acid, consisting of 1 part of acid

and 3 of water, at a temperature of from 88° to 100° Fahr. It is then treated with a mixture consisting of 1 part of fresh burnt lime, 2 parts of carbonate of soda, and 1 part of white lead, for not more than from 10 to 15 minutes, in order that the spots should only assume a yellowish brown tint and not a dark brown. The pieces of horn are now washed with water, and wiped from adhering moisture with a cloth, and introduced into a cold bath consisting of a decoction of Brazil wood, marking 10° of Beaume's areometer, and 1 part of caustic soda, marking 20°. As soon as the colour is properly developed it is to be removed and washed with water, and carefully pressed between cloths, and laid aside from 12 to 16 hours, and then polished. The decoction of logwood may be made by boiling 1 pound of the Brazil wood in 2 to 3 quarts of water, and the caustic soda may be obtained from any soap-boiler, or it may be produced by heating a solution of carbonate of soda to the boiling point, and adding slacked lime in powder, until a drop of the liquid, on being filtered, does not effervesce, and setting it aside carefully covered until the sediment has deposited. If a little oxide of zinc be added to the white lead employed as a mordant, bluish-red shades will be obtained, while salts of tin give fine scarlet tints. Archil may be used instead of the dye-woods, and still finer tints may be produced with cochineal. The characteristic feature of this process is the use of the caustic soda in the dye-bath; and this fact accounts for Prof. Wagner not having been able to succeed in staining horn with any vegetable or animal dyeing material.—*Polytechnisches Centralblatt*, No. 5, March, 1854.

PHOTOGRAPHY.

Production of direct positive Photographic Portraits on Cotton, Linen, Silk, &c.—The Messrs. Wulff, of Paris, have lately presented to the Academy of Sciences a number of photographic portraits taken upon cotton, linen, &c., which are said to be remarkable productions, and not inferior to those produced in any other way. They can be produced in a few seconds, and sold at a very moderate price. The process is still secret, but it is probably done by impregnating the tissue with a solution of colodion containing iodine.—*Comptes Rendus de l'Académie*.

In connexion with these portraits we may mention that in the Dublin Exhibition there were several specimens of printed fabrics produced by the action of light, and exhibited by Mr. R. Smith, of Blackford, in Perthshire. These were produced by imbuing the tissue with some sensitive substance, and exposing it to the action of the sun-light, which passed through a plate of glass upon which were pasted pieces of black paper or a negative colodion photograph. The cloth, after sufficient exposure, which is usually about two to twenty minutes, is then removed in order to fix the image. Thus, for example, a white pattern may be produced upon a blue ground by employing solutions of citrate or tartrate of iron and prussiate of potash, the pattern being fixed by washing in a very dilute solution of sulphuric acid; this is a variety of the cyanotype. Brown and chamois may be produced by a solution of bichromate of potash, the excess of the salt upon the parts not acted upon by the light being afterwards washed away, or by washing them with acetate of lead a yellow ground may be formed. The metallic substances thus fixed upon the cloth may then be made to serve as mordants, and all shades of red, yellow, purple, blue, green, &c., produced.

Photographic Printing and Engraving.—Beuvière proposes to obtain copies of letters, &c., by covering a glass plate with a varnish, and then engraving upon the varnish the subject to be copied in the same way as is usually practised for etching. This glass plate is then used as a negative photograph, a sheet of prepared paper being placed behind the glass plate, against which it is evenly pressed by means of a partially filled air bag. On exposure to the light the paper will be acted upon underneath the parts from which the varnish had been removed by the graver. After sufficient exposure, the letters on the paper are fixed in the usual way. This is simply an application of a process invented by M. Narcisse Salières, a painter of Montpellier, and described by him under the name of diaphonous engraving, and by which some beautiful photographic etchings have been produced.—*Le Génie Industriel*, Jan. 1854, p. 42.

Vitrification of Photographs upon Albumenized Glass.—M. Plant has made a very pretty application of photography, which will, no doubt, find many ornamental applications. If a negative photograph upon albumenized glass be exposed to a gradually increasing heat until it becomes red hot, the albumen will be destroyed and the picture will become positive by reflection, and that with a power and brilliancy that is quite remarkable. The picture will be formed by the pure silver, which will adhere with such force to the glass that it may be polished without injury. If the picture in this state be exposed to the action of hydro-fluoric acid it will etch the glass wherever it is not protected by the metallic silver; perhaps it would also be possible to strengthen the lines of silver by a further deposition by electrical means, and thus produce a plate from which a matrix might be taken which would yield impressions like an ordinary copper-plate. If instead of heating the glass plate to redness, it be heated until the glass softens, and the surface undergoes semi-liquefaction, the picture will sink into the glass without suffering any injury, and will become covered, to a certain extent, with a varnish of glass; the picture will, so to say, be placed between two surfaces of glass, and thereby lose a portion of its sharpness; nevertheless, a very delicate sketch is obtained, which, by using a positive picture, may perhaps serve for church and other ornamental windows, as, without doubt, they would admit of being painted in the ordinary way.—*Moigno's Cosmos, Revue Encyclopédique, T. iii. p. 331.*

INVENTIONS AND PROCESSES CONNECTED WITH FOOD, AGRICULTURE, AND RURAL ECONOMY.

Best method of Storing Corn in magazines for several years.—Cartier and Bobierre propose to store corn in large quantities in great closed wooden chests lined with thin sheet zinc, the joinings being all soldered. It should, however, be first dried at a gentle temperature not exceeding 120° to 150° Fahr., which would be sufficient to nearly destroy all insects. And after being introduced into the great chest a stream of carbonic acid gas should be introduced into the bottom, so as to drive out the air through a pipe in the top, which may then be closed. The gas might be made with chalk or oil of vitriol, as in making soda water, or by forcing a current of air through a furnace filled with red hot coke. Corn may be preserved in this way without suffering the slightest change, for more than ten years, and at a very trifling cost.—*Journal der Landwirthschaftlichen Fabrikantenkunde, Bd. V. Heft p. 6, 179.*

Zeolithoid or Beerstone.—A very curious brittle substance, of a yellowish brown colour, packed in wooden boxes lined with tin foil, was exhibited in the German department of the Great Exhibition of 1851, under the name of *Bierstein* or beerstone. This substance was first made by a Mr. Rietsch, steward of a Count Leo Von Rasumowski, in Moravia, and consists, apparently, of ordinary wort, boiled with hops, and concentrated into an extract, with the addition of a quantity of sugar, and then poured into these boxes, where it is preserved. It dissolves in water, and on being fermented, yields a very palatable beer, which, although it cannot be equal to beer brewed in the ordinary way, would, undoubtedly, yield an excellent substitute in remote districts, where beer cannot be made by the usual method. It seems specially adapted for use in long voyages, and would indeed be a real luxury on board ships. A company is now working it on a large scale at Böhmisch-Rudolitz, in Moravia, and have already supplied orders from London, Havre, Hamburg, and even from New York. A Mr. Moore has lately taken out a patent in England for a similar manufacture, and, strange to say, no mention is made of the original invention. It appears to us, that this system of appropriation is a disgrace to the commerce of Great Britain.—*Gemeinnützige Wochenschrift, No. 3, 1853.*

On the relative Values of different kinds of Meat as Food, by Marchal of Calvi.—M. Marchal took 20 grammes of the muscles of the pig, ox, sheep, calf, and hen, which contained neither sinews, or cellular tissue, or adhering fat, except what naturally exists between the muscular fibres, and dried them in a water bath for several days, and thus ascertained the loss which each sustained by desiccation. The following are his results in 100 parts:—

	First Experiment.		Second Experiment.	
	Solid Matter.	Water.	Solid Matter.	Water.
Pork	29.45	70.55	30.25	69.75
Beef	27.70	72.30	27.50	72.50
Wether Mutton	26.55	73.45	26.35	73.65
Chicken	26.35	73.65	26.30	73.70
Veal	26.00	74.00	25.55	74.45

According to these numbers we should arrange the meats in the following order of their relative nutritive powers:—pork, beef, mutton, chicken, veal. This order is, however, not the true one, because the leanest meat contains a certain amount of fat, and because this substance is not so important an article of food as the pure muscles, it is necessary to ascertain how much a certain quantity of meats contain, before we can judge properly of its relative nutritive value. M. Marchal accordingly treated the dried flesh with ether, to dissolve out the fat, and obtained the following results:—

	Fat soluble in ether.	Pure muscle insoluble in ether
Beef	2.54	24.95
Chicken	1.40	24.87
Pork	5.97	24.27
Mutton	2.96	23.38
Veal	2.87	22.67

The last table shows that the true order should be, beef, chicken, pork, mutton, and veal, a result which experience confirms. (It may, however, be remarked, that there is considerable difference between the same kind of meat derived from different animals, and that the same amount of two different kinds of beef-broth, both containing the same amount of water, may have very different nutritive values. Further investigations are required upon this point.)—*Comptes rendus de l'Academie*, 1852. No. 16.

ART. VII.—*Bulletin of Industrial Statistics.*

COST OF PRODUCING IRON IN SCOTLAND COMPARED WITH THAT IN SILESIA AND WITH THE MOST IMPROVED SYSTEM OF CHARCOAL SMELTING ON THE CONTINENT.

One of the chief barriers to the introduction of free trade, or at least of a greater approach to it, in France and Germany, has been the fear of destroying the iron trade of those countries, which is very considerable—that of France having been, in 1846, 522,000 tons, and being now perhaps not far from one million of tons; while that of Prussia in 1851 was 348,000 tons. As it is not probable that so important a branch of industry will be sacrificed in either country, the only way in which free trade can arrive will be by removing the necessity for protection; that is, by introducing such improvements into the manufacture as will lower the cost of production to the standard of Great Britain. The following facts may help to show whether such is possible or not:—

According to the Mining Journal, No. 821, p. 237, for 1851, the average cost of producing one ton of common Scotch pig iron in that year was as follows:—

32 cwts. of calcined ironstone (black or clay band), and containing 62.5 per cent of iron, at 12s. per ton	...	...	£	s.	d.
45 cwts. of coal, at 4s. per ton	...	...	0	19	2
16 cwts. of cinders, at 1s. 6d. per ton	...	...	0	9	0
7 cwts. of limestone, at 3s. 6d. per ton	...	...	0	1	3
Labour at the smelting works	...	...	0	1	3
Sundries, inclusive of horses	...	...	0	3	3
Interest upon capital (£20,000 for a furnace, inclusive of all other outlay at the smelting works and mine)	...	...	0	2	0
			0	3	4
Total	...	...	£	19	3

According to Mr. Eck (Inspector of Smelting Works in Silesia) and Mr. Chuchul (Machinist),* the average cost of producing one ton of iron in Scotland, as calculated from the average cost of the raw materials employed at the chief works, is as follows:—

	£	s.	d.
35 cwt. of calcined ironstone (black-band, supposed, on an average, to contain 57 per cent. of iron), at 10s. per ton ...	0	17	6
2 tons 5 cwt. of splint coal, at 3s. 8d. per ton ...	0	8	3
10 cwt. of limestone, at 4s. 6d. per ton ...	0	2	3
$\frac{3}{4}$ of small coal, at 1s. 6d. ...	0	1	$\frac{1}{2}$
Labour at the furnace ...	0	1	0
Interest upon capital, wear and tear of furnaces and blast apparatus, and sundry expenses, usually reckoned in Scotland at 6s. per ton ...	0	6	0
Total cost of one ton of Scotch pig iron ...	£1	16	$\frac{1}{2}$

In many of the German iron works, from the smallness of the furnaces, the superior quality of the iron, (which fetches a much higher price than the commoner kinds of British, and especially Scotch iron,) joined with a considerable protection, the economy of working was not, up to a late period, carried to the same extent as in France, and now to a considerable extent in Great Britain. The average cost of production in Germany of coke pig iron approximates very closely to that established with great care at the furnaces of the Königsbütte, in Upper Silesia, and which may be thus stated:—

	£	s.	d.
Ore ...	1	0	8 $\frac{1}{2}$
Coal ...	1	1	8 $\frac{1}{2}$
Lime ...	0	1	10 $\frac{1}{2}$
Small coals ...	0	5	2 $\frac{1}{2}$
Wages ...	0	3	1 $\frac{1}{2}$
Wear and tear, management, interest upon capital, &c. ...	0	11	10 $\frac{1}{2}$

£3 4 6

Silesian iron would thus appear to cost, according to the first of the preceding estimates, £1 5s. 3d. more than Scotch iron; or £1 8s. 4 $\frac{1}{2}$ d. according to the second; or 64 per cent. and 73 per cent. respectively. In the Scotch estimates, the coal is reckoned at cost price at the mines, the latter being supposed the property of the proprietor of the iron works; whilst in the German, on the other hand, the coal is calculated at the usual selling price. By allowing for this difference, the German estimate will be reduced to the extent of 10s. 10d.; that is, one ton of pig iron will cost in Silesia £2 13s. 8d., or 14s. 5d. more than Scotch pig, according to the first estimate; and 17s. 6 $\frac{1}{2}$ d. according to the second; or 36 per cent. and 48 per cent. respectively. A considerable reduction could be effected in the item of management, which, according to the preceding estimates, is nearly double as much in Silesia as in Scotland, if the trade increased so as to enable the works to be increased. The iron works of the latter have generally twice, and sometimes four times, as many furnaces as those in the former, and each of these is also generally capable of producing perhaps four times as much iron; hence the greater expense under the head of management in Silesia. Several other improvements may also be introduced so as to lower the expenses of working, such as an improved method of removing the cinder, the substitution of machinery for hand labour in lifting the ore to the top of the furnaces—a method which is very generally practised with small furnaces—the better economising of the waste gases, &c. Another item to be also taken into account is the superior quality of the German iron, and the greater loss sustained in remelting Scotch pigs, from the adhering coarse moulding sand. Summing up all the deductions which may be thus made, it is probable that iron can be produced with coke in the coal dis-

* *Zeitschrift für das Berg Hütten, und Salinenwesen in den Preussischen Staale*
—Herausgegeben von R. V. Curnall. Bd. 1, Lief 2.

tricts of Germany, and in certain of those of France, for £2 10s.; but it is very improbable that it can ever be made as cheap as in Scotland, from the co-existence of certain circumstances there which scarcely exist anywhere else. Iron cannot, however, be made in other parts of Great Britain as cheaply as in Scotland; and it is probable that the average cost of producing one ton of pig iron of the same quality is fully as high, if not higher, in England, than what we have just set down as the minimum cost in Germany. From these calculations it would appear that German, and we may add, French, coke made iron will very soon be in a position to compete upon equal terms with that of Great Britain.

Let us now see how the case stands with regard to charcoal iron. Instead of giving the results obtained at any particular iron works, we shall quote the opinion of perhaps the best authority in Europe upon the subject, M. Leplay.* From the most elaborate calculations, founded upon the present working of iron in Styria and Carinthia, he has come to the conclusion, that by a proper cultivation of the forest, which should be in the hands of the iron master, the economical production of the charcoal, and the most improved system of smelting, &c., the cost of producing one ton of charcoal pig iron, would not be more than £2 18s. 3½d., as is seen from the following statement:—

	£	s.	d.
50 cwts. of Ironstone at 8s. 4½d. per ton,	1	0	11½
5 cwt. of Flux (limestone) at 2s. 4½d. per ton,	0	0	7½
23 cwt. of Charcoal, at 19s. 2½d. per ton,	1	2	1
Wages, calculated upon the basis of a weekly production of 271 cwts. of pig iron,	0	1	9½
General Expenses—management, wear and tear, rent, sundries, &c.	0	8	5
Interest upon Capital, including land, at 10 ⅓ cent. upon £27,750	0	4	5½

Cost of 1 ton of Charcoal Pig Iron, £2 18 3½

This scarcely exceeds the average cost of producing one ton of superior coke iron in England, notwithstanding the cheapness of fuel, and the other unexampled advantages, as an iron producing country, which Great Britain enjoys. There is, therefore, sufficient margin left for improvement, to enable the continental iron master to produce iron, whether with coke or with charcoal, at a cost sufficiently low to compete unprotected with British iron.

The same observations apply with equal force to the manufacture of bar iron from charcoal pig iron. According to Leplay, the following table may be considered to represent the cost of making one ton of charcoal bar iron, if the manufacture be carried on upon the best principles:—

	£	s.	d.
25.19 cwts. of Charcoal Pig Iron, at 2s. 11d. per cwt.	3	13	5½
49.8 cwts. of Dried Wood, at 7s. 2½d. per ton,	0	17	11½
Wages,	0	9	0½
General Expenses,—management, wear and tear, &c.	0	14	5½
Interest upon Working Capital, and Capital sunk in forest land, at 10 per cent. on £66,000,	0	14	5½
	£6	9	3½

or if we deduct the sum allowed for interest upon capital, the cost of producing one ton of charcoal bar iron would be £5 14s. 10½d., a sum below which the price of English bar iron has hitherto rarely sunk, and to which it will scarcely again fall, with the increased price of fuel in every part of Great Britain.

THE CUTLERY MANUFACTURE AT SHEFFIELD, IN ENGLAND, AND AT SOLINGEN, IN GERMANY.

Most of our readers are perhaps aware of the unrivalled facilities possessed by Sheffield, for the manufacture of cutlery, principally owing to the organization of the workshops, and the division of labour. In the manufacture of the single article of table knives, 700 persons are employed in the forging, 900 in the grinding and polishing, and 1,300 with the preparation and putting on of the handles.

* Annales des Mines, 1853. Tome III., p. 463.

There are more than 3,000 persons engaged in the manufacture of pen and pocket knives, who work up nearly £100,000 worth of materials, of whom 250 to 300 are smiths, 500 grinders, and perhaps 2,500 men and boys employed in the other operations. In the making of razors, there are, it is said, no less than 160 smiths engaged, (two to each anvil); and 900 males, and 200 females, in the manufacture of scissors. The quantity of ivory and deers' horn used for knife handles is enormous, 140 to 150,000 lbs. of the former, and perhaps, 500,000 lbs. of the latter. The enormous extent of this cutlery branch of the Sheffield trade, enables all the most recent improvements, especially in machinery, to be rapidly introduced, and a most perfect division of labour to be adopted; and if to these advantages we add, that Sheffield is situated in the midst of a coal and iron district, it will at once be admitted, that there are few localities in the world in a position to produce cutlery to compete in price or in quality with that town and its neighbourhood. Nevertheless, it has found a rival in Solingen and the neighbouring villages of Gräfrath, Wald, &c. The system of manufacture followed in those localities is different from that of Sheffield; there are, properly speaking, no workshops provided with tools, and let to the workmen with the necessary power, where an article can be made from its first stage, until it is finished. There is, however, as perfect a system of division of labour; the iron or steel is given out to the smiths who forge the articles at their own workshops, for which they find all the necessary tools; the forged pieces are then given to another set of workmen, who file them, then to a third, who grind them, and so on, until the last set finish them. It is, in fact, a domestic manufacture, with this advantage, that the merchant or undertaker having considerable interest in the improvement of the articles, and in the cost of producing them, endeavours as far as possible to bring the best machinery and processes into use in the district.

Several articles can now be produced much cheaper at Solingen than at Sheffield, as, for example, scissors. All articles of this class, whether wrought or cast, with the single exception of the very cheapest kind of half-raw cast iron scissors, which are made in Sheffield at 4s. per gross or 4d. per dozen, are now extensively made at Solingen, and sold at lower prices than they can be made at in England. The better the quality of the scissors is, the greater is the difference of price between those of British and German manufacture; in some cases this even reaches one-half in favour of the latter; the consequence is, that the British manufacturers have been driven by the German from all foreign markets, and even a considerable importation now takes place into Great Britain itself for home consumption. It is proper to remark, that this great difference in favour of the German Scissors does not arise from inferior quality or finish, for in this respect they are fully equal to anything of the kind produced in England.

The lower and middle qualities of table, pen, and pocket knives, especially those used in parts of America and the East Indies, &c., are now also produced at a slightly lower price than in England, and considerable orders for exportation are now sent by British houses to the Solingen manufacturers. Another article in which the German cutler has the advantage in price over the British is the large sabre-like knives or matchets used for cutting down the sugar cane, and for other purposes in the West Indies, South America, and along the west coast of Africa. From 4,000 to 5,000 boxes, of ten dozen each, are now annually exported from Solingen, chiefly upon orders from English houses.—*Karl. Karmarsch in Anlt. Bericht über die Londoner Ausstellung* iii. Thl. s. 4.

COST OF OBTAINING AN ACT OF INCORPORATION FOR A TRADING COMPANY IN THE UNITED STATES.

In the United States, where every species of manufacturing industry is carried on by the system of partnership *en commandite*, and where the greatest facilities are afforded for the formation of such companies, the expenses of incorporation are marvellously low. Mr. Whitworth mentions one instance where the capital of the company was 600,000 dollars (£120,000), and the expenses of the act of incorporation only 50 cents, or 2s. 1d.!! We recommend this important fact to the attention of those who follow the trade of law-making.—See *Whitworth's report on the New York Industrial Exhibition*.

JOURNAL OF INDUSTRIAL PROGRESS.

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 ART I.—INDUSTRIAL EDUCATION. No. III.—*On Societies for the Promotion and Encouragement of Industrial Arts.* By the EDITOR.

If there be any one proposition, upon the truth of which we could reasonably hope that an unanimous opinion would prevail in Ireland, it is undoubtedly that our industry wants encouragement, and the natural resources of the country require to be properly developed. How this is to be done is quite another matter, and one too upon which much diversity of opinion no doubt prevails. Without discussing the individual merits of each of the many ways in which industry might be promoted, we may assume that special education is at least one of the most potent agents. We have already on two occasions brought this subject under the notice of our readers. In the first instance,* we alluded to the principles upon which the higher schools for industrial education should be founded; and in the second instance† we gave a brief account of the progress of agricultural education in Ireland; and we now purpose to follow up the subject by some remarks upon the influence which societies, acting as the collectors and distributors of information amongst the manufacturing class, stimulating by prizes inventions of various kinds, and encouraging by their judicious approval all such inventions, or the introduction of new branches of manufacture, would exercise on our material progress.

Although at first sight it may appear strange that we should consider a society of the kind alluded to as an educational institution; yet a little reflection will show that a properly organized one, which would confine its functions to the realizing of possible and rational results, would be in truth an adult school, where men may learn all the most recent information concerning their business, and be taught how to apply it to the best advantage.

That every thing, however, depends upon the organization, is shown by the little profit which has hitherto been derived from the many societies

* *Vide Journal of Industrial Progress*, No. II., February, 1851.

† *Ibid*, No. IV., April, 1854.

which have been founded ostensibly for the promotion of industry in Ireland, contrasted with the results which have followed the labours of analogous institutions elsewhere. Our societies may be divided into two distinct classes, the one established for rational and attainable objects, but which, with few exceptions, have neglected those objects; and the second, those which have undertaken impossible and absurd tasks, which of course could not be performed. In both cases the results, so far as the promotion of Irish industry is concerned, have been trifling. And yet had several of the societies of the first class been properly organized, and their functions limited to practical objects, a great impulse might have been given to our manufactures. With the view of directing attention to the importance of establishing such a society, or of remodelling some existing one, which would be the more desirable course, we shall state what we would consider to be the objects, for the carrying out of which such a society would be beneficial. Before laying down our own plan, it will be useful to state in a few words, the constitutions of some of those societies established elsewhere for similar objects, whose labours have been successful, in order that our readers may have the materials of comparison which would enable them to form a proper judgment on the matter.

Among all such societies, the first place undoubtedly belongs to the *Société d'Encouragement pour l'Industrie Nationale* of France, not alone from its extent, and the vast influence which it has exercised upon French industry, but because, like all French institutions connected with human progress, it has a cosmopolitan character, which renders it in some respect the centre of industrial information for Spain, Italy, and even for Western Germany and Holland.

The Society of Encouragement was founded in 1802, and has since then carried out its objects with undiminished activity, and with considerable success. These objects are limited and may be summarized as follows: 1, to encourage all inventions and improvements in the useful arts by means of prizes and medals; 2, to institute experiments and trials in order to test the value of new processes, or to solve important questions connected with the industrial arts; 3, the publication of a fortnightly journal containing the reports of the committees of the society upon all inventions, processes, or other methods, upon which the decision of the society is asked, and a succinct account of all useful discoveries made in connection with industry in France or elsewhere; 4, the providing of scholarships for deserving pupils in the schools of arts and manufacture, and in veterinary and other colleges; and 5, the annual distribution of medals to such workmen and foremen in agricultural and manufacturing establishments, as have distinguished themselves by their good conduct and by their talents.

The funds of the society are altogether derived from the annual subscriptions of the members, each of whom pays 36 francs (£1 9s.) To become a member of the society, one must be first proposed by a member, then admitted by the council, and lastly by the society. The privileges of members are, to receive a copy of the journal free, no matter where they may reside, and to attend and vote at all the meetings of the society.

These meetings are of two kinds—general meetings of the whole society, and meetings of the administrative council. The former are held twice in the year, one in each session. The object of the one which takes place during the first session, is: 1, to lay before the society a resume of its labours for the preceding year, which is done by the secretary, and of the receipts and expenses by the committee of finances and the censors; 2, the renewal of the council of administration; and 3, the distribution of medals of encouragement. The general meeting which takes place during the second session is devoted to the distribution of prizes. The meetings of the administrative council are held twice in the month, and, as we have before stated, the members have the right to attend and take part in the deliberations and votes.

These meetings are perhaps the most important feature of the society, and the one which is of most interest to us. The proceedings consist of the reading of the reports of the committees upon some improvement in industry or some new branch of trade; also the reading of communications upon similar subjects, and the presentation of pamphlets and books, and the discussion of any matters of interest contained in them; and the exhibition of specimens of new raw materials, or the products of new manufactures, &c.

The journal which is published under the title of *Bulletin de la Société d'Encouragement*, may be considered to be the minutes of those meetings. It consists of two sheets quarto, with two or more plates of machinery, &c., engraved in the highest style of art. The articles consist: 1, of the reports of the committees, and the memoirs adopted by the administrative council, a resume of the proceedings of each meeting, and extracts from the correspondence of the society; 2, notices of every thing done elsewhere which may interest the commerce and the industry of the country; 3, original articles consisting of extracts from industrial travels or voyages, dissertations upon scientific subjects bearing upon industry, notices, memoirs, documents and statistics relative to French or foreign commerce, descriptions of new or little known machinery, &c. &c. The journal forms at the end of the year a large volume illustrated with about 40 plates, representing the most important inventions and improvements in machinery effected during the year. The 52 volumes already published, form a complete encyclopedia of the progress of the arts, during the first half of the present century.

The administrative council consists of a president, two vice-presidents, a secretary, and two assistant secretaries, a treasurer, and two censors, seven committees, namely, finance, mechanical arts, chemical arts, economical arts, and fine arts, applied to industry, agriculture, and commerce. Each committee consists of eight or nine ordinary members, and one or more ad-joint and honorary members; there is also a series of honorary officers, consisting of those who have held the office the year previous. The functions of each committee is to examine into the nature and merits of each invention and process submitted for the consideration of the society, and to report upon them. The report is usually drawn up by one member in the name of the whole committee, who then alter it if necessary, and approve

of it before its submission to the whole administrative council. If approved of by that body, and by the members of the society present at its meeting, the report is printed in the journal, and illustrated where necessary at the expense of the society. These reports are usually documents of great ability, and the system, which may be said to be peculiarly French, is one which might everywhere be imitated with advantage.

To perform such functions, it is needless to say, that the members composing the council must be superior men, and such is always the case, nearly every distinguished man of science in Paris is a member of one of its committees, and from the same rank is chosen its president and other officers. For example, the president for the past year was M. Dumas, the celebrated chemist, the secretary was M. Charles Dupin, one of the most distinguished men of France in applied science, and the two adjoint secretaries were M. Combes, Inspector-General of mines, and professor to the school of mines, and one of the best writers on that subject in Europe, and M. Peligot, professor of chemistry to the *Conservatoire des Arts et Metiers*, and verifactor of assays to the mint, and a man of high position as a chemist. The committee of finance consists of bankers, solicitors, government officers connected with the administration of finances, and, in fact, all men qualified to fill the office from their education and pursuits. The committee of mechanical arts consists of members of the civil engineering corps (*Ponts et Chaussées*), machinists, manufacturers, mining engineers, and mathematicians. The committee of chemical arts is composed of some of the most distinguished cultivators of that branch of science in France, of whom it is only necessary to mention the names of M.M. Payen, Balard, Fremy, Cahours, Bussy, Salvetat, &c. The same observations apply to all the other committees, the members of which are carefully selected, not for their rank in life, their fortune, or any other accidental circumstance, but for their especial qualifications for the duties to be performed.

It is no wonder, therefore, that the public attach great importance to the opinions expressed in the reports of such a society, upon the new inventions or processes brought under its notice, and that manufacturers should be so anxious to submit their processes and products for its judgment. Every invention which has been made the subject of a favourable report by the society, is sure to find a ready reception among manufacturers, and to have its merits fairly tested. To the poor inventor, and the greater number are invariably so, this is of immense consequence, as it introduces him at once to the large manufacturers who would be likely to employ his invention; and here we may mention another function of the society which we forgot to state above: namely, of assisting such poor discoverers and inventors to secure patents as may not have the money to do so themselves.

The prizes proposed by the Society of Encouragement refer chiefly to such improvements and inventions as would be of great public benefit, especially those connected with the great branches of national industry, the introduction of new ones, the utilizing of hitherto useless substances, &c.

The next of these societies which we shall notice, is the London Society

of Arts, as it was one of the earliest formed, having been founded so long ago as the year 1754, although only incorporated by charter in the year 1847. This society consists of a president, a council, composed of a number of vice-presidents and other members, a number of committees, of which we shall speak presently, and the ordinary members. The following is the rule of the society relative to the admission of members:—

“Candidates for admission as members must be proposed and recommended by not less than three Members of the Society, one at least from personal knowledge, according to a form in which the name, rank, profession or business, and usual place of residence of the Candidate must be distinctly stated. Ladies are eligible as Members. The paper thus signed will be read at a General or Ordinary Meeting of the Society, and be afterwards hung up in the Society's room until the second following meeting, when the Candidate will be balloted for. The Annual Subscription of every Member is not less than Two Guineas, payable in advance, and commences from the quarter day next preceding the date of election. Any Member, by a payment of not less than Twenty Guineas, may at any time commute his annual subscription. Foreigners and persons not residing in Great Britain may become Corresponding Members, without payment of any subscription, if proposed and elected in the usual manner.”

The privileges of a member are: 1, to be present at, and to take part in the proceedings of all the ordinary meetings of the society, and to introduce two visitors at such meetings; 2, to be present and vote at all general meetings of the society; 3, to have personal free admission to all the society's exhibitions; 4, to receive a copy of the weekly journal of the society, or of any other work in which its transactions or proceedings may be published by the society subsequently to his election, and to the use of the library; and 5, to introduce any number of friends to inspect the models, paintings, and works of Art, in the society's house.

The objects of the society are well defined by their charter—

“For bestowing pecuniary and honorary rewards for meritorious works in the various departments of the Fine Arts, for discoveries, inventions, and improvements in agriculture, chemistry, mechanics, manufactures, and other useful arts; for the application of such natural and artificial products, whether of home, colonial, or foreign growth and manufacture, as appear likely to afford fresh objects of industry, and to increase the trade of the realm by extending the sphere and operations of British commerce.”

These objects are carried out chiefly in three different ways. First, by means of 33 standing committees, each composed of three members, and which may be classified under five heads; 1, raw materials; 2, machinery; 3, textile fabrics; 4, metallic, vitreous, and ceramic manufactures; and 5, Fine Arts. Secondly, By weekly meetings at which papers are read on some of the subjects relating to inventions, improvements, discoveries, and other matters connected with the arts, manufactures, and commerce of the country; and afterwards the merits of the communication are fully and freely discussed. Thirdly, by occasional exhibitions.

The different communications sent to the society are submitted to the several special committees appointed for the class of subjects to which they belong, and according to the reports of these bodies the society is guided in reference to the granting of the rewards. Formerly the society published transactions, in which were published these communications in full, illustrated with the necessary engravings; and a more valuable repertory of

facts connected with improvements in the various branches of industry scarcely exists. It now publishes a weekly journal, containing the reports of its proceedings, a resume of the papers read at its meetings, and of the discussions thereon, and the correspondence of the society upon various interesting subjects connected with its objects.

A chief function of the standing committees is, to suggest from time to time a list of desiderata in manufacturing industry, for the supplying of which the society would grant premiums. In order to give our readers an idea of the subjects included in the most recent of these lists, and which may be considered in the light of a key to industrial progress, we shall give the desiderata in textile fabrics and allied manufactures:—

“An essay on wools; the manner of rearing and feeding the sheep, and improvement in preparing the material for use. 2, A more economic method of employing gold and silver in woven fabrics. 3, An account of improvements in the method of transferring the pattern from the original design to the cards of the Jacquard loom. 4, The successful application of some means (as electricity, for instance) for producing ornamental designs in woven fabrics, which shall be cheaper and easier of application than those at present employed. 5, An account of the methods at present practised in France for dyeing and dressing morocco leather. 6, The best mode of dressing kid and calfskins for the upper leather of boots; the improvements required are, strength of the grain, and a good, firm, black dye. 7, The production of paper, either wholly or in part from new materials, such materials not being more costly than those now used. 8, The best essay on the preparation of paper for India and hot climates generally. 9, The best method of colouring paper in the pulp with indigo, and with greens of various hues, the colours not liable to be affected by gas. 10, Improvements in the manufacture of transparent paper. 11, The best method of glazing paper in the web. 12, A method for more thoroughly sizing machine-made paper with animal size. 13, The invention of a means of copying letters by which the inconvenience at present attending the use of the ‘style’ may be obviated, and both the original and the copy shall be permanent. 14, An account of recent improvements in the manufacture by steam power of carpeting whether Brussels velvet-pile, or terry, especially of processes by which the warp-threads are coloured to form the pattern before weaving; also for the application of new materials in the manufacture, uniting durability, economy, and elegance of design. 15, The best method of finishing the edges of machine-made bobbin lace (in imitation of pillow lace), so as to supersede the use of a separate pearl edge usually sewn on. 16, Improvements in the manufacture of embroidery by machinery, so that the production may more closely resemble that now made by hand. 17, A ready mode of taking casts of the feet, which may be used as lasts for making boots and shoes.”

The exhibitions of the society are of three kinds: 1, exhibitions of inventions, or a collection of articles that have been invented, patented, or registered, during the twelve months next preceding; 2, exhibitions of select specimens of British manufactures and decorative Art; 3, special exhibitions either of the pictures, drawings, sketches, and studies of an eminent contemporary artist; or of some branch of illustrative Art, as wood engraving, chromo-lithography, &c.

This sketch of the constitution of the Society of Arts will be sufficient to show how admirably it is organized for carrying out its objects; and we may further mention, as a more striking proof, that hitherto its influence upon the progress of English manufacturing industry has been very considerable. Many of the most important improvements effected in machinery, and in mechanical and chemical processes, made during the past half

century, have been more or less connected with that society, as its Transactions amply show. Many also of the new and important vegetable and animal raw materials introduced into commerce during the same period, have been chiefly recommended to the public through its instrumentality. More recently the society has taken up many questions connected with the social condition of the working classes, with education, &c. In connection with the subjects just mentioned, we must here allude to a new and useful function which the society has assumed. It has endeavoured to unite with itself all the local institutions throughout England, for the purpose of diffusing the recent information which it, as a great central metropolitan institution, has such facilities of acquiring, through these channels, to every part of the country. The union is effected upon the basis of the most perfect security to the continued independence of the institutions, and the freedom of their self-government. This system of union is of considerable benefit to the local institutions, which are enabled to get books and journals at a considerable reduction of price, through the medium of the society; while the latter, in turn, is in a position to acquire a considerable amount of valuable local information, upon the condition of trade, &c.

There are several provincial societies in France organized upon the plan of the *Société d'Encouragement*, the best known of which is the Industrial Society of Mulhouse (*Société Industrielle de Mulhouse*), a society which, for the importance of its labours, and the journal which it publishes (*Bulletin de la Société Industrielle de Mulhouse*) is scarcely inferior to any society in Europe. It receives no aid whatsoever from the state, and was even very recently refused any assistance by the government towards endowing the school of design which had been established under its patronage. Nevertheless, it has since contrived to build a handsome edifice for the purpose, at an expense of £2,000 (50,000 francs), and its school is now in the most flourishing condition. And yet Mulhouse is a town of only 20,000 inhabitants!

Every little state in Germany has now its society for the promotion of industry or *Gewerbeverein*, all of which are to a great extent on the plan of that of Paris, and need not therefore be further alluded to. One important feature of all these societies is the publication of a journal, which, in addition to the papers read by the society, gives extracts from, and sometimes entire translations of, the most important memoirs contained in foreign journals. Our own pages can testify to the usefulness of many of these societies, by the copious extracts which we have made from their journals in our notices of recent improvements of manufactures. The extraordinary progress in all branches of industry which Germany has made in recent times, is owing in a great degree to the action of these associations, and chiefly to the information which they have been the means of spreading among the manufacturers of their respective states. Every fact of the slightest interest which comes into the public domain in any part of the world is known in a few months through every part of Germany. How different in this country! Unless in the case of trades in which large capital is embarked, such as that of linen, there is no means whatever by which an Irish small manufacturer or tradesman may become

acquainted with any improvement or invention; for even our direct intercourse with other countries is too limited to influence our condition to any great extent.

Since the decline of Holland from her former rank as a commercial nation, she too has found herself isolated to some extent from the intellectual and industrial life of other countries. But fortunately for Holland, it is an independent nation, and has still that vitality of self-existence which exists not in a soulless province like Ireland. It has accordingly determined to remedy that isolation by the establishment of an International Society of Industry, Agriculture, and Commerce (*Vereeniging voor Volkswijst*). The aim of this society is to establish a direct connection between practical men connected with industry both in Holland and in foreign countries, and to introduce and diffuse, without the least delay, all foreign discoveries that may come to its knowledge. To effect these objects it has established:—1. A permanent exhibition of all raw materials and manufactured products which may be sent to it, and which may be considered suitable. 2. The society takes upon itself the charge of ordering, receiving, and forwarding, or taking upon consignment, all objects interesting to the industry of Holland, which may be asked from or offered to it. 3. The society will give advice and information in reply to any inquiry addressed to it respecting agriculture, industry, and commerce. 4. It takes charge of demands for patents, and assists in every possible way inventors to obtain patents. 5. The society will conduct the sale of all machines, &c., sent for exhibition, the charges being made as low as possible. 6. The society sends to their resident correspondents throughout the kingdom such objects as may be of special interest and importance for each locality. 7. It has also formed a collection of journals and periodical works relating to agriculture, commerce, and industry, and especially of those which are scarce and difficult to be had; from which extracts, with the requisite drawings, are made for a reasonable fixed remuneration. 8. The society awards premiums for all important objects sent to it; and are prepared to make exchanges of samples, drawings, and models, &c., with other societies or institutions. 9. And finally, the society endeavours to establish a correspondent in every commercial and manufacturing district of importance throughout the world, who will maintain a correspondence with it relative to all improvements, &c., connected with manufactures, and will forward to it all pamphlets, tracts, books, &c., bearing upon the objects of the society; and who will, when required, purchase specimens of raw and manufactured produce, machines, &c., and forward them to Holland.

The three societies to which we have called our readers' attention have each their peculiar merits; but perhaps a society on the plan of the *Société d'Encouragement* of Paris, slightly modified, so as to include certain functions borrowed from the other two, would be the best adapted to the circumstances of Ireland.

Now the Royal Dublin Society, which has hitherto confined its industrial labours to agriculture, if we except the triennial exhibitions which have been productive of so much good, might very easily so enlarge its functions

as to become a society of this kind. And in doing so it would not depart in the slightest degree from the spirit of its charter, but, on the contrary, carry out more effectually the original intentions of its founders. With the increased funds which it is probable will now be at its disposal, it has an opportunity of conferring the most important benefits upon the country, at the same time that it will establish further claims upon it for support. If sufficient real patriotism exist in it, free alike from the bias of clique and of party, and anxious alone for the welfare of the country, the requisite modification in its organization would be effected before six months.

Hitherto, the intellectual energies of this country have been almost entirely exhausted in the contemptible and purposeless strife of parties; and even the little which has been, or even is now devoted to its legitimate object, is frittered away in numerous small societies and cliques, incapable from their insignificance of effecting the slightest good. If all our intellectual force could be concentrated into two great bodies; one devoted to abstract science, and the other to practical subjects, science would be promoted, trade and commerce increased, and the character of the country raised. The functions of the first belong to the Royal Irish Academy, whilst that of the latter may, and ought to be, fulfilled by the Royal Dublin Society. In the hope that it may accept this, the noblest mission it could carry out, we would respectfully suggest to its members a plan of organization, which, if adopted, would render the society far more powerful than hitherto, and make it a truly great national institution.

We would propose that the real work of the society be carried on by eight committees, elected annually, in addition to those which might be necessary to perform the other duties entrusted to the society. Each of those committees should have special charge of a separate department of industry, say as follows:—1, raw materials; 2, machinery; 3, products and processes of mechanical manufactures; 4, products and processes of chemical manufactures; 5, agriculture, and subjects connected with botany and natural history, not included under raw materials; 6, commerce; 7, social improvements; and 8, Fine Arts applied to industry. The functions of these committees would be chiefly as follow:—1, to suggest subjects for premiums; 2, to prepare reports upon the nature and merits of every improvement or invention submitted to the society, and upon communications sent in to compete for the premiums offered—the reports to be read at the meetings of the society; 3, to decide upon the best means of carrying out experiments or investigations which would be of service to the industry of the country. As the duties here assigned to the committees presuppose high qualifications on the part of the members of them, it is almost unnecessary to say that such bodies should be composed of all the eminent men in the country, both scientific and practical, and not of men selected, as is usually the case in Ireland, for their mere social position or wealth, and without the slightest regard to their qualifications for the duties to be performed. The duties here assigned to the committees already indicate the objects which we would propose the society should carry out, and which we shall now proceed to summarize.

I. One of the leading objects of the society should be to select subjects which it would be desirable to have public attention specially directed to, and to offer premiums for their investigation or solution. Generally speaking, the subjects for which such prizes might be offered would be included in some of the following categories:—1. For the discovery of new mines of lead, copper, &c., deposits of potter's clay fit for the manufacture of earthenware, or of any other mineral substance of use in the arts. 2. For the successful working of any of these mineral materials. 3. For the successful introduction into Ireland of any branch of industry not hitherto carried on there. 4. For all inventions and improvements effected in any branch of industry; or the introduction of any new raw material of home or foreign origin, as a substitute for those previously employed. 5. For the best essays upon the nature and sources of the different raw materials employed in those branches of manufacture carried on in Ireland; upon the processes of manufacture adopted in other countries; upon the different branches of manufacture which might be advantageously introduced into this country; and upon commercial law and other questions bearing upon commerce, social improvements, and applied Art, &c.

II. The appointment of commissions to investigate special questions of immediate utility to the country.

III. Annual exhibitions of all the raw materials discovered; the inventions and improvements effected in manufactures, and the best specimens of the produce of certain manufactures made in Ireland during the year. Also an exhibition of the best productions in design and ornamental and illustrative Art.

IV. The collection of statistics and other information connected with the trade and commerce of Ireland.

V. The union of all the local institutions of Ireland, for the better promotion of the objects of all.

VI. The appointment of correspondents in all the chief seats of industry and commerce in Europe and America, whose business it would be to communicate anything of importance relating to trade and commerce.

VII. The organization of a fund to found free burses for the education of sons of workmen of promising talent; to assist inventors in perfecting and securing their inventions; and to relieve such inventors as may have fallen into poverty.

VIII. The holding of fortnightly or monthly meetings for the reading of all communications, reports of committees, essays, &c., and their full discussion.

All important communications, valuable essays, and the reports of the committees, might be published after each meeting of the society; and a short abstract of the discussion might also be prepared, containing all the information of any importance.

Such appears to us to be the field in which, at the present time, the greatest results in Industrial Education may be attained in this country, and such are the measures which appear to us to be at the present time eminently practicable, even with the small means Ireland now possesses. It is impossible within our necessary limits to do more than point out shortly

the best examples for the emulation of those of our countrymen who seriously and disinterestedly desire to serve this nation, and the application of those examples to existing circumstances. It will be for our readers to undertake something towards the speedy realization of somewhat at least of what has been done in this department, and is doing in almost every country around us.

ART. II.—*On the uses to which Turf might be applied in Ireland.* No. I.
TURF PAPER.

IN no part of Europe, of the same extent, could we perhaps find so large an area of country covered with peat bogs as in Ireland. And further, these bogs are amongst the deepest, and the turf which they yield probably the best, that is found anywhere. Yet how little have we availed ourselves of this immense wealth of fuel! With the exception of its use for domestic purposes, and in a very few factories, no successful effort has yet been made in Ireland to make turf the basis of any extensive manufacture, save the attempt now being made to obtain a number of substances from the products of its distillation, such as paraffine, wood spirit, &c. If that project succeeds it will undoubtedly grow into a great branch of industry, but it would be premature to say anything further of it here, as we purpose devoting a good deal of space to that subject in an early number.

It is when we look to other countries that we are able to discover our own shortcomings. Whilst we follow the rude and unsystematic mode of turf-cutting, practised from time immemorial, and produce a fuel far dearer than coal imported from England and Scotland, we can see, not only an immense manufacture of bricks carried on in Holland with turf, and alum works, breweries, bakeries, and many other factories, both in France and Germany, using no other fuel, but even a considerable manufacture of wrought iron, arms, and general hardware carried on with it. But it is not alone by these countries, in which turf has long since been employed as a fuel, that we are outstripped. Three or four years ago no one used turf in Sweden, and many perhaps did not believe that it could be employed. Wood has, however, been growing scarcer and dearer every year in Sweden, and at length people bethought themselves of turf, and accordingly the government sent persons to the countries where turf is used, to collect information respecting the best manner of using it; and so well have they taken advantage of the knowledge thus gathered together, that already they have left us far behind. Why should this be so? Surely it is we who, having the more bogs, ought to lead the way in all improvements connected with the utilization of peat, and convert, what are now merely centres of disease and demoralization, and refrigerators of the surrounding country, into sources of employment and wealth.

A great deal might really be done with our peat bogs if attention was

concentrated for some time upon them. Scarcely a month passes without some project being formed connected with the utilization of peat; we have in fact merely to select, all trouble of invention is saved us. The stock of projects already on hands is so large and so varied, that it would be very much better to endeavour to carry a few of them out, rather than attempt to add to their number. Many of them are no doubt worthless, but many may also prove of considerable value, either directly or as suggestive of further improvements. There is, for example, the idea of making paper from turf, which we have more than once alluded to in this journal, and which it appears is now being successfully carried out in more than one place on the Continent.

The energy and perseverance displayed by some of our manufacturers in developing the process of making straw paper, and the perfect success which has attended their efforts, is a sufficient guarantee that if some of them could be induced to turn their attention to that of making turf paper, our turf bogs, from being fringed with misery and starvation, would soon be surrounded by the fruits of industry. In the hope that some one may seize upon the idea and embody it in a factory, we shall mention what degree of success has attended similar attempts made elsewhere.

Turf bogs of a considerable extent and thickness, and very generally of ligneous character, are found in many parts of Piedmont. This peculiar quality of the turf appears to have first suggested its use as a material for paper making, and accordingly a number of trials were instituted at Turin, which appear to have been remarkably successful. From these experiments we learn that certain kinds of turf may enter into the composition of paper, to the extent of from 80 to 90 per cent., and into that of mill-board even to 95 per cent. The other materials employed in addition to the turf were indiscriminately old ropes or bagging, and the bark of the mulberry. The economy of using turf instead of the materials now employed is stated to be fully 50 per cent.*

In Germany also, successful experiments have been made within the last few months of the same kind. Mr. Keller, of Kühnheide, in the Saxon Erzgebirge,† has manufactured some excellent paper of low qualities from fibrous or flow peat, which possessed considerable strength, and had a sort of fatty feel, which appears to render them particularly well adapted to form packing paper for certain goods. Even so far back as 1838, Mr. L. Piette, in a small book which he published at Cologne, upon the different indigenous substances from which paper might be made, showed that a good common paper might be produced from the upper layer of fibrous turf. From his statements it would appear that 100lbs. of turf would only yield 25lbs. of paper, but this proportion would no doubt vary very considerably. But even assuming that dry turf only produced one-fourth of its weight of paper, it would still be the cheapest material that could be employed. On the edge of a large bog turf can be readily had in large quantities for 2s. 6d. per ton; so that the raw material of one ton of paper,

* *Annales du Commerce Extérieur*, Jan., 1854. (Official Publication of the French Minister of Agriculture, Commerce, and Public Works.)

† *Polytechnische Centralhalle*, 1854. p. 46.

exclusive of a little scutching waste or other strong fibre to give strength, could be had for 10s.

The process of manufacture of the turf paper resembles in many respects that now followed for making straw paper. The peat is first thoroughly washed, to separate all the earthy matter from the fibrous portion; the latter is then put into a strong caustic lye, where it is allowed to soak for twenty-four hours. It is then removed and placed for about four hours in a bath of weak hydrochloric acid, and kept constantly agitated; then washed in water, and placed in a weak solution of alum. After steeping for a short time in this solution, the liquid is run off, and the mass bleached by means of chlorine, and mixed with from five to ten per cent. of rag-half-stuff and worked up in the engine, and made into paper in the ordinary way. This is the process of M. J. Lallemand of Besançon in France, where it has been patented. It is evident that the fresh peat as cut in the bog would answer for making paper according to this process, which of course would save the expense of drying, stacking, &c.

As a material for making all kinds of papier maché and carton pierre, turf paper, from the low price at which it could be produced, would be invaluable. Papier maché has already been applied to a thousand uses, but it is still far from having received one-tenth of the development of which it is capable, and which no doubt it will receive if paper could be produced at a much lower price than it is now, and if the present impolitic and oppressive duty were removed.

ART. III.—*Application of Murexide as a Colouring Matter for Wool.*

THE beautiful researches of Liebig and Wöhler upon uric acid and its derivatives made us acquainted with a peculiar substance, to which they gave the name of alloxan. This body is obtained by adding very gradually one part of uric acid to four parts of nitric acid, of a specific gravity of from 1.45 to 1.5. The uric acid is dissolved with evolution of nitrogen and carbonic acid, accompanied by a considerable rise of temperature, which must be prevented as much as possible; on cooling, the mass becomes nearly solid, from the deposition of white granular crystals of alloxan. If these crystals be drained and dissolved in a very small quantity of water, and exposed to spontaneous evaporation in a moderately warm room, large, brilliant, colourless crystals, in the form of short right rhombic prisms, will be obtained. Alloxan is remarkable for the facility with which it undergoes changes when treated with different substances, and for the number of curious compounds thereby produced. Thus, if sulphuretted hydrogen gas be passed through a solution of it, sulphur is precipitated and a new body formed, to which the name of alloxantine has been given, or if its solution be slightly acidulated and a slip of zinc placed in it, the same body will be produced under the influence of the

nascent hydrogen evolved during the dissolution of the zinc. Alloxantine being sparingly soluble in cold water, readily separates in crystals, which may be obtained pure by solution in hot water, for, unlike alloxan, it is not decomposed by continued boiling. If 4 parts of alloxantine and 7 of alloxan be dissolved in 240 parts of boiling water, and 80 parts of carbonate of ammonia be added, a very peculiar body will be formed, which will crystallize on the liquor cooling. These crystals are of a beautiful garnet red colour by transmitted light, and have a beautiful iridescent green by reflected light. To this body the name murexide was given, from the murex or shell-fish, from which it was supposed the Tyrian purple was formerly procured. Previous, however, to the experiments of Liebig and Wöhler, Dr. Prout had described the same substance under the name of purpurate of ammonia, but obtained in a somewhat different way. So readily is this body formed, that a solution of alloxan will stain the skin purple in consequence of its production. This fact led its second discoverers to imagine that, like the Tyrian purple, it might be employed as a dye stuff. The difficulty, however, of obtaining it, and of fixing it upon the fabric when formed, prevented, for that time, the idea from proving fertile.

Some time since, however, Dr. Sacc turned his attention to the subject, and led by the fact above mentioned, that a solution of alloxan stained the skin, came to the conclusion, that by impregnating a piece of woollen cloth with that substance he might be able to produce the murexide directly in the tissue. He tried the experiment, and succeeded in dyeing a piece of cloth of an anaranthus tint far more beautiful than that produced by cochineal. He communicated the results of his first experiments, still incomplete, to M. Albert Schlumberger, who has succeeded, by modifying and completing the experiments of Dr. Sacc, to render the process, merely indicated by the latter, perfectly practicable.

His process is simple enough: he prepares a solution of alloxan, formed of 30 grammes of alloxan to each litre of water, and soaks the tissue to be dyed in it, the excess of liquid being then squeezed out in the ordinary way, or by pressure between rollers. The cloth is then dried at a gentle temperature, and after an ageing of 24 hours the colour is brought out by passing the cloth over a roller heated to 212° Fahr. For this purpose the drying machines composed of several drums would answer perfectly, the cloth being successively passed over each, the greatest care being taken to avoid folds; woollen yarn and wool should be put in a stove heated by steam. According as the heat is communicated to the cloth, a magnificent purple tint, far more beautiful than anything hitherto produced by the ammoniacal preparation of cochineal, or by red dye woods, makes its appearance as if by magic. The intensity varies according to the strength of the solution of alloxan which has been employed. It is only necessary to wash the cloth in cold water to give to the shade its full brilliancy.

M. Sacc found that the finest and most vivid shades could only be communicated to the tissues mordanted with salts of peroxide of tin, and M. Schlumberger has confirmed this observation. Cloth not mordanted did not give very satisfactory results, even after a prolonged exposure to warm

and damp air. He obtained the most satisfactory results by soaking the cloth in a solution composed of equal parts of perchloride of tin and oxalic acid, of a specific gravity of 1.006. In this solution, at a temperature of about 100° Fahr. the cloth is to be allowed to remain for an hour, then rinsed and dried, and is then fit to be treated with alloxan. If stronger solutions of the mordant be employed there is a considerable loss of colouring material, and a deterioration of the shade. This may be attributed to the presence of too great an excess of stannic acid, which from its opacity may mask the murexide, or by its acid reaction may decompose it. This is especially the case if chloride of tin be employed instead of stannate of soda. Experience has shown that fabrics freshly mordanted give better results than those which have been mordanted for some time; the depreciation in purity and brilliancy of tint in the latter may even amount to 20 or 30 per cent.

Murexide, as we have already remarked, being produced by the action of heat and ammonia, it occurred to M. Daniel Dollfus, and the other members of the committee for the chemical arts, appointed by the *Société Industrielle* of Mulhouse, to report upon the memoirs of M. Schlumberger, to try the effect of exposing a piece of cloth, treated with alloxan, to the vapours of ammonia. The result confirmed their anticipations, for the colour was immediately produced, without the necessity of ageing the cloth after its impregnation with the alloxan. There can therefore be no doubt that the best results will be obtained in future by the employment of ammoniacal vapours, for, besides the saving of time, there will also be a saving of alloxan. This substance is very liable to decompose, especially in the presence of even minute traces of reducing agents, such as protochloride of tin or sulphurous acids; traces of the latter substance always remain in the cloth after the operation of bleaching, no matter how well washed it may be, and would be quite sufficient to prevent the formation of the murexide.

As yet all the attempts that have been made to communicate the murexide purple to cotton or silk have failed, that substance having an affinity apparently only for wool, to which it gives a very durable and permanent dye. Sun light, so destructive to other purples, appears to have but little action upon that of the murexide; a piece of cloth dyed of a rose colour, had its tint scarcely altered by exposure to the full action of the strongest sunshine during two days, and the colour was only fully discharged by an exposure of more than two months. Boiling water and steam completely destroy the colour produced upon cloth mordanted with salts of tin; the decoloration commences in boiling water at a temperature of about 153° Fahr., and augments with the increase of temperature. This destruction of the dye is caused by the action of the mordant, for cloth dyed without the use of a mordant, not only supports to a certain extent the action of boiling water, but even acquires an uniform and perhaps a more beautiful and deeper tint than that given by prepared woollen fabrics. Further experience may show that hot water and the application of ammonia alone may be advantageously substituted for the mordanting and the passage over heated cylinders.

Cold alcohol or ether have no action upon murexide purple; the former liquid destroys it at boiling temperature, without being coloured purple as water is. Alkalies, especially in a caustic state, are very destructive to it; if a piece of cloth dyed with murexide be dipped into a solution of caustic soda, it assumes a violet blue colour, and is then decolorized. Soap, acting as a weak alkali, after a time alters it. Chlorine has no immediate action upon it, at least not in weak solutions. Acetic and oxalic acids are not sufficiently energetic to immediately discharge the colour. Hydrochloric, nitric, and sulphuric acids act as decolorizers, nevertheless the latter acts less quickly than the first two, and, what is singular, the colour almost destroyed by sulphuric acid reassumes a rose violet by immersing the tissue in ammonia.

Bichromate of potash, chlorate of potash, acetate of lead, acetate of alumina, are without action upon murexide. This is not the case, however, with reducing compounds, such as proto-chloride of tin, sulphuret of ammonium, proto-sulphate of iron, which destroy the rose tint very rapidly; the proto-chloride of tin produces a blue tint before it decolorizes it. The reduction of the murexide gives birth to a new substance, which, in its turn, may reproduce that substance by a properly conducted oxidation.

From these reactions it is evident that the rose, amaranthus, and purple shades produced with the murexide, and which exceed those produced by all other means in richness and brilliancy of tints, have also the advantage of being the most solid and durable, an advantage which will no doubt be soon appreciated.

We have now to speak of the sources from whence the supply of uric acid may be obtained, should the employment of murexide become general. At present the price of that substance, which has never hitherto become an article of commerce, would be so high, that the murexide purple would be far more expensive than that produced with cochineal. But if we recollect, that independent of the excrements of serpents, from which hitherto uric acid has been made, those of pigeons, and especially of all carnivorous birds, silk worms, &c., and, above all, Peruvian guano, which may be obtained in immense quantities, are very rich in uric acid, and it may be produced from them at a very moderate price as soon as it becomes an article of commerce. No doubt, if necessary, fowl might be so fed as to produce it in much larger quantities than they do naturally.

Connected with this part of the subject we may mention, that in the making of the alloxan from the uric acid, a considerable quantity of the former remains in the acid mother liquid, from which the crystals of alloxan separate. This portion could not be used to impregnate tissues in consequence of the nitric acid present, and would cause a considerable loss of material, and a considerable enhancement of the cost of the dye, unless it could be utilized. If a piece of zinc be introduced into the acid mother liquid, alloxantine will be formed, which may be recovered by evaporating the liquid and allowing it to separate out. This substance, as we have before remarked, will also produce the purple colour, and a mixture of it with alloxan will afford the best conditions for its production.

M. Schlumberger has indulged in some curious speculations relative to

the existence of this colouring matter ready formed in nature which it may be interesting to notice. M. Sacc has found that poultry, and especially birds with very brilliant plumage, such as the different parroquets, do not produce sensible traces of uric acid during their period of moulting, whilst the quantity is very large when their feathers are fully developed. The question naturally suggests itself, what becomes of the uric acid in the former case? May it not be transformed by some, as yet unknown, metamorphosis in the animal body into a substance like alloxan, capable of colouring the feathers? Murexide, as we have observed, is green by reflected light, a substance then which gives violet (red and blue) and green (yellow and blue), can undoubtedly produce all shades of colours, which are made up of those three colours. How curious if it should hereafter be found that murexide was indeed the source of all the varied hues of birds' plumage! Still further, it is chiefly those animals which have but one means of exit for their excrements, and who produce large quantities of uric acid, that exhibit a display of colouring. Thus, for example, we have the skin of the serpent and lizard, the scales of fish, the wings of butterflies, often coloured in the most gorgeous manner, whilst the skins of the mammalia are dull, and without that iridescence and metallic lustre which is so characteristic of the colouring of some of the classes of animals mentioned. These are, however, mere speculations, but they nevertheless lead to a very unexpected supposition. The ancients were acquainted with a process for dyeing wool of a fine purple, which has been lost to our days, or at least is only practised in the East. Tradition, however, tells us that this beautiful purple tint was produced by pounding a quantity of small shell fish, and adding to the mass either a quantity of urine in the state of putrefaction, or water in which some of the same shell fish had been allowed to putrify. The cloth soaked in the liquid produced by these mixtures only developed the beautiful purple colour after long exposure to the air, and probably to heat. This mode of producing the colour, so strikingly resembles that by which the new colour of murexide is produced, that one is tempted to believe that the Tyrian purple was produced by that substance; and that many centuries before the beautiful discovery of Liebig and Wöhler, murexide was formed by the action of ammonia in the putrid matter employed upon substances derived from the uric acid which must exist in the intestines of the shell fish pounded up.—See the *Bulletin de la Société Industrielle de Mulhouse*, No. 123, p. 242, for Dr. Schlumberger's Memoir.

ART. IV.—*Process employed for the preparation of a Textile Fibre from the Chamaerops Humilis or Dwarf Palm.*

AMONG the numerous interesting objects in the French department of the Great Exhibition of 1851, was a specimen of paper, made from the fibre of the *chamaerops humilis* or dwarf palm. This plant is the most northern representative of the most beautiful of all vegetable forms, being found in

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several parts of Italy, especially in the neighbourhood of Nice, and near Bordighera, between Monaco and San Stefano, where there is a considerable grove of them. It is one of the few palms that belong to the social plants, large tracts being generally covered with it, such as at the estuary of the Ebro, and in Valencia in Spain; and, like the cocoa nut palms, is only found along the sea coast, or at least in maritime districts.

The social character of the dwarf palm was one of the greatest obstacles the colonists of Algeria had to contend with; for whole regions are covered with this plant, the deep and tenacious roots of which are exceedingly difficult to eradicate. If land be left uncultivated for a few years, it springs up as grass does with us. This troublesome and apparently useless plant appears now to be destined to become a source of wealth to that colony.

A few years ago, a Mr. Fléchy conceived the idea of employing some of the plants of Algeria which yield fibre in the manufacture of paper. His attention was first directed to the aloe and the banana; but as these plants are not sufficiently abundant, and their fibre cannot be had at a sufficiently low price, he had to renounce the idea of employing them. He then had recourse to the leaves of the dwarf palm, and in this case his experiments were crowned with the most complete success, for not only was he able to manufacture a superior quality of paper, but the raw material was cheap and abundant. This first attempt to utilize the fibre of the dwarf palm soon led to others; it was at once employed for cordage and other purposes; and lastly, though short, it is found to be capable of very great division, and adapted for spinning. Experiments have shown that it is admirably adapted to produce flax cotton, the manufacture of which has, it is said, commenced.

It will be very interesting if the process of Clausen, which proved so unsuccessful with flax, should be found economical in its application to the fibre of the dwarf palm. If the experiment now making proves successful, the process may be applied to very many other fibres, which would otherwise be unfit for spinning, and may hereafter open up a wide field of industry.

The production of a fibre from the dwarf palm, although of great importance to France, from its possession of Algiers, where it occurs so abundantly, is not of much importance in these countries. We have noticed the subject therefore, not so much on account of the fibre, but because the process by which it is proposed to obtain it, appears to us to be applicable to a great many other plants which yield fibre, and the preparation of which presents certain difficulties. We shall accordingly describe this process in a few words, in order that those who may have an opportunity of testing its application to the leaves of other palms or tropical plants may do so.

The leaves of the dwarf palm, and indeed of most palms, do not decompose readily when steeped in water at the ordinary temperature; they may remain immersed in it even for a period of eight months, without undergoing fermentation. The process of steeping, by which flax is prepared, would not therefore answer for preparing the palm fibre. Palm leaves, like those of other plants, if left in the ground in their moist condition, will decay in a

comparatively short time, but, it is needless to observe, that the fibre would be destroyed under such circumstance, or at least would be rendered unfit for manufacturing purposes.

If we expose the leaves to the action of steam, before steeping them in water, the phenomena observed will be different. Apparently the leaves will have undergone no change, and it will be just as difficult to isolate the fibre; yet a peculiar modification of some of the substances constituting the leaves will have taken place, which is soon manifested by the development of heat in the mass, and by the active fermentation which sets in, under the influence of which the leaves become covered with a yellowish powder, the germs of an active vegetation of fungi.

Up to a certain stage of this fermentation the fibre undergoes no change, whilst the parenchyma becomes decomposed, and may be removed by mechanical means with great facility. Upon this molecular change in the chemical constituents of the leaves, Dr. Foley of Algiers bases a process for preparing palm fibre.

The palm leaves, in the state in which they are gathered, are introduced into a vessel of zinc or of wood, or of any other convenient substance, having a false bottom pierced with holes. When the vessel is properly filled and covered, a jet of steam is admitted, and allowed to act upon the leaves for about eighteen hours uninterruptedly; the vapour which condenses flows through the holes in the false bottom, and is drawn off from time to time. It has been found that steam a little hotter than 212° Fahr. acts with greater rapidity and much more perfectly than at that temperature; the duration of the action of the steam is also found to vary from time to time, according as the leaves operated upon are more or less young. When steam cannot be applied, the leaves may be boiled for a considerable time with the same result; but it is needless to remark, that steam is to be preferred when possible.

As soon as the steam has been allowed to act sufficiently long upon the leaves it is turned off; and the leaves allowed to cool slowly, either in the vessel itself or in another closed one, where they are allowed to remain in their moist condition. Towards the fifth day a sort of mould forms on the surface of the leaves, analogous to that which is observed upon bread. On the ninth day the leaves appear covered with this mould, which forms as a white powder, spreading from leaf to leaf, and constituting a kind of network. A few days after, the mould becomes greenish, then brown, and finally almost black. On the twelfth day the epidermis of the leaf has already become soft; and the central fibrous layer detaches itself readily from the two external coatings, whose coherence sensibly diminishes. Towards the fifteenth or twentieth day, according to the age of the leaves, the softening of the gum-resinous matter becomes such, that a simple brush suffices to isolate the fibres, which are obtained of their full length, and of a fineness and tenacity which fit them for a great variety of purposes. In order to clean the fibres from the adhering gum resin, M. Foley proposes, when the leaves have attained the proper degree of softening, to pass them between a series of rollers which will squeeze out the soft matter; or to subject them to the action of a cylinder or drum provided with a number of brushes,

and turning with a certain velocity in a sort of case; or a conical roller, revolving upon a horizontal table, may be employed for the same purpose. With whatever form of machine this operation is performed, it should be done while the fibre is moist. After this preliminary cleaning it should be dried in the open air, or, what is preferable, in stoves or drying rooms, and again passed between the cylinders or other analogous machines, in order to remove any dust which it may contain. If the fibres in this state be subjected to the action of a hydraulic press, they are rendered much finer and softer, and their colour is also altered from brown to gray. They are then ready for undergoing the usual operations through which such fibres are passed previous to spinning. The latter operation may be performed on the same machinery as that employed for hemp and flax, and the fibre may be spun either dry or wet, according to the quality of yarn desired. The yarn produced may be applied to the manufacture of sail cloth, sacking, towelling, and in fact to all fabrics now made from hemp and the inferior kinds of flax. The fibre is also an excellent substitute for hemp in the manufacture of ropes and other cordage.

When one considers the unbounded supply of vegetable matter which may be had in all tropical countries, the fibrous tissue from which might, if easily separable, supply raw material for the manufacture of paper and for other purposes, such a process as that which we have just described, and which is not merely an experimental one, but one now capable of being carried out on a large scale, is deserving of the serious attention of all interested in the British tropical colonies, on the one hand, and of those connected with the manufacture of paper, hempen cordage, &c. There is one great advantage which it possesses, and which we must not omit to mention, namely, that after a plant to which this process may be found applicable, has been steamed, and allowed to decompose until the parenchyma has disintegrated, it may be dried in the sun, and transported to some convenient place, where all the subsequent operations may be performed.—(*The account of the process just given is derived from Le Genie Industriel, Feb., 1854.*)

ART. V.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

MANUFACTURES FROM MINERAL SUBSTANCES.

Manufacture of Porous Bricks.—Weinberg recommends adding to the clay intended to be used for making the bricks for cottage chimneys, granaries, light walls or partitions between rooms, &c., a quantity of vegetable matter, the burning out of which would leave the brick light and porous. For this purpose he recommends the spent bark of tan yards, cut straw, chaff, leaves of the pine, &c. Perhaps one of the best, as it certainly would be the cheapest, in Ireland, would be the dust of turf, or dried turf mould. Porous bricks made in this way would be very cheap.—*Mittheil. für den Gewerbeverein des Herzogth. Nassau, through Polytechnisches Centralblatt, Febr., 1854.*

IMPROVEMENTS AND INVENTIONS CONNECTED WITH CHEMICAL PROCESSES.

Application of Zinc White to the Manufacture of Visiting Card Paper.—One of the most recent substitutions of zinc white for white lead is that of Warren De la Rue, who prepares visiting cards with it, which have the *valuable property of not being blackened by the action of sulphuretted hydrogen*. For this purpose, the zinc white is ground with as little water as possible, and 8 lbs. of it, in a moist condition, are mixed with 2 pints of a strong solution of glue, containing one-fourth of its weight of glue, and 3 pints of hot water. The mixture is then passed through a sieve, and is spread with a brush upon thin Bristol board, or on strong paper, &c. The former is coated two to four times, and the latter once or twice, either on one or on both sides; the paper prepared in this way may then be glazed by pressure between polished plates of copper, in the ordinary way. But as the surface of zinc white is liable to be streaked by copper, it is better to employ highly glazed millboard. In consequence of this property, zinc white is well adapted for making tablets, which may be written upon with pencils of copper or its alloys, which do not wear rapidly. As the paper for this purpose does not require to be very highly glazed, a different preparation may be employed, consisting of 8 lbs. of moist zinc white, 2 pints of strong glue, and 6 pints of water.—*Repertory of Patent Inventions*, Nov., 1853, p. 321.

DYEING AND THE PREPARATION OF COLOURS.

To make Damp Blue darker.—In the production of damp blue with prussiate of potash and acid, it is always usual to add to the mixture some of the precipitate produced by chloride of tin (dyers' red liquor) and prussiate of potash, in order to communicate an agreeable violet tone to the blue. Instead of this substance, a precipitate containing iron as well as tin might be very advantageously employed. The following prescription of Mr. W. Grüne, Jun., appears to give the best results:—1 lb. of a solution of chloride of tin, marking 60° of Beaumé's areometer, and 1 lb. of a solution of proto-chloride of iron, at 50° of Beaumé, are to be diluted with 2 quarts of water, and then added to a solution of 1½ lbs. of prussiate of potash in 3 quarts of water. A bluish white precipitate is formed, which is to be collected upon a filter, and added in requisite proportion to the damp blue. By this means a colour can be obtained which is considerably darker, whilst it is equally beautiful as that prepared with the pure ferro-cyanide of tin.—*Deutsche Musterzeitung*, No. 6, 1853.

MISCELLANEOUS.

On the Engraving of Figures on Gilded Glass, by Bernhardi of Königsberg.—A peculiar method of executing figures, arabesque ornaments, and other designs upon glass, is practised in Germany with great success, especially in Königsberg, and other parts of East Prussia. No varnish is used to make the gold-leaf attach itself to the glass, the mere force of cohesion being sufficient. This is effected by touching the glass with the tongue after washing the mouth with water and a little spirit, and then applying the gold-leaf, which is found to adhere sufficiently to the glass, especially when the slight film of moisture left by the tongue upon the glass has evaporated through the gold-leaf, and allowed the glass and gold to come into perfect contact. The adhesion is not, however, sufficient to permit of figures being engraved, and the glass must accordingly be covered with the finest tissue paper, and then with some folds of other paper, and all the places where the gold was laid on rubbed with a steady but moderate pressure, by means of a blood stone or an animal tooth, until all dull spots have disappeared, and the whole presents a compact burnished surface in contact with the glass when seen through it. This gilded surface is now ready for engraving, which is readily done by means of a steel needle or point which cuts through the gold. When the profile of the figure and the borderings are formed, the remainder of the gold is carefully removed by means of a piece of pointed wood; the details of the figure and ornaments are now engraved, and every particle of the gold not forming part of the design carefully cleared off. This done, the whole side of the glass upon which the gold-leaf is attached, is covered with a varnish composed of 3 parts of clear venetian turpentine, and 1 part of mastic, in tears. These are melted together in a glazed earthen vessel, over a charcoal or coke fire, and stirred about with a chip of limewood, until the froth which is formed when it begins to boil

has disappeared, and the liquid appears clear; a sufficient quantity of the finest lampblack is now added, to render the varnish perfectly black; when cold it forms a hard, dry, shining mass. This varnish is laid on with a fine hair pencil upon glass, previously strongly heated by holding it over a charcoal fire; while the varnish is still in a melted state a sheet of paper is laid upon it, and firmly pressed upon the glass: in this way the design is effectually protected from all accident. This style of ornamentation would be admirably adapted for bull work, or as a bordering for mirrors, especially for the small ones forming the backs of cabinets, buffets, &c.—*Gewerbevereinsbl. d. Prov. Preussen*, through *Polytechnisches Centralblatt*, No. 4, Febr. 1854.

Rough method of determining the Quality of Roots, such as Potatoes, Beet, &c.—As the relative specific gravity of two roots bears an approximate ratio to the amount of solid matter which they contain, the determination of the former would give for practical purposes sufficiently accurate results as to the relative qualities of root crops. The manufacturers of potato starch in Germany use a very simple process for determining the quality of their potatoes; they prepare a solution of salt of a certain density, into which they throw the potatoes; all those which float are considered too watery to be profitably used in the manufacture of starch, and are rejected. By taking a number of vessels and partially filling them with solutions of salt of different densities, and then successively introducing the roots into one vessel after another, until a solution was found in which they nearly floated, we can ascertain in a rough way its relative quality when compared with another root. All agriculturists engaged in experimental cattle feeding, or experiments upon root crops, or upon the relative fitness of different fields for growing green crops, should try this method. M. Vilmorin has proposed to test the amount of sugar in beet in the same way, but used for that purpose solutions of treacle; for this purpose, however, the results are liable to lead to very great errors.

Method of detecting whether Olive or other Non-Drying Oils have been adulterated with Poppy or other Drying Oils.—Nitrous acid has the property of converting the oleine or the liquid constituent of almond, olive, and other non-drying oils into a crystalline substance, termed elaidin, while it has not the same action upon the drying oils. Wimmer has accordingly proposed a process to detect whether olive or almond oil has been adulterated with any of the cheap drying oils, founded upon this property. He introduces some iron filings into a flask, provided with a cork, into which is inserted a long bent tube, and then pours some strong nitric acid upon them; a part of the nitric acid will be decomposed, and nitrous acid fumes evolved, which pass off by the bent tube, and are made to pass through a sample of the oil to be examined, placed in a glass with a little water. In performing the experiment the end of the tube must be just in contact with the water upon which the oil is made to float. In a short time the whole of the non-drying oils will solidify into a semi-crystalline mass, while any poppy or other drying oil, if present, will float on the surface. In a similar way the adulteration of drying oils with non-drying ones can of course be detected.—*Kunst and Gewerbeblatt für Bayern*, Dec., 1851, p. 754.

PROCESSES CONNECTED WITH RURAL ECONOMY AND AGRICULTURE.

Method of preparing Straw for Cheap Upholstering.—M. Krichten, of Mayence, has proposed the following method of preparing straw, so as to prevent it from breaking up, and at the same time communicating more elasticity to it, for cheap upholstering purposes for the working classes. The straw, in as unbruised a condition as practicable, is to be tied into bundles of from 1 to 1½ pounds. These bundles are to be placed for 12 hours in rain or river water, great care being taken to prevent them from being broken. The moist straw is then to be twisted into thin ropes, or plaited, in the way horse-hair is sometimes brought into commerce. The twisted ropes or plaits are then to be so arranged in the bottom of a vat or large barrel as to form a kind of mat; over this is sprinkled a layer of unslaked lime, then another layer or mat of the straw, and so on, until the barrel is nearly filled. Water is now poured on in sufficient quantity to fill the barrel. From the slaking of the lime the whole mass heats, and in five hours the operation is ended; the lime-water is withdrawn by a plug in the bottom, the straw washed four or five times, until it is perfectly free from all adhering particles of lime, after which it is hung up to dry.—*Gewerbeblatt für das Grossherzogthum Hessen*, 1853, No. 48.

ART. VI.—*Bulletin of Industrial Statistics.*

COST OF CULTIVATING COTTON IN GEORGIA.

The cost of raising 40 bales of medium long staple Georgian cotton is thus stated:—

Plant.

Value of a plantation sufficiently large to grow 40 bales of cotton per annum, with the necessary seedling grounds, and allowing $\frac{2}{3}$ of the soil to remain every year in fallow. This sum includes the price of the ground, the cost of erecting a dwelling, a house for the superintendent, a building for machinery, huts for the negroes, and sheds for mules, carts, and tools, &c.		10,000 dollars.
Value of 50 slaves, men, women, and children, at an average of 500 dollars each,		25,000 "
Capital embarked in plant, &c.,		35,000 dollars.

Annual Expenses.

Interest upon capital embarked in plant, at 7 per cent., ...		2,450 dollars.
Shoes, clothes, and medical attendance of the negroes, at 15 dollars per head,		750 "
Salary of Superintendent,		300 "
Furniture, clothes, &c., for the planter's family,		800 "

Total expense of the crop, 4,300 dollars.

Producing 40 bales of S. I. cotton of the average weight of 350lbs., or a total of 1,400lbs., at 30 cents the lb.	4,200 dollars.
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In these calculations, the depreciation upon the mules, carts, and utensils, and the sundry small accidental expenses are not taken into account, as they are considered to be compensated for by the annual increase in the value represented by the negroes.

The produce of cotton per given area of land differs so much in different plantations, that it would be difficult to give a mean, even approximately. Some planters grow their rows of plants at very wide intervals, others on the contrary, grow them close. The usual basis of calculation is a certain weight of cotton for each negro employed. Two bales of Georgia Sea Island cotton are usually reckoned for each "full hand." A full hand is a man in good condition; a woman and an old man are considered as the equivalent of a full hand, as are also two boys, for example, of from 13 to 14 years. A plantation force of 50 negroes of all kinds represent about 20 full hands, and are considered to manage as much land and as many plants as will yield a crop of 40 bales net of cotton.

It is a fact well established, that the finer the cotton the more uncertain is its growth, and also the more hazardous is the produce of the crop, taking into account the area planted, and the hands employed. This observation applies particularly to the plantations on the main land, where the planters frequently abandon the cultivation of the fine kinds, in order to cultivate the coarser.

The value of property in slaves rises or falls according to the price of cotton. A full hand, say, a young man of from 18 to 25 years, is worth from 600 to 900 dollars; and if he is capable of executing the work of a carpenter, or of a smith, he may be estimated at from 1,000 to 1,200 dollars. The young women are considered to be worth from 500 to 700 dollars; but in selling a plantation force, the general price is understood to apply to men, women, and children, and this may be set down at from 250 to 600 dollars each, according to the price of cotton and the proportion which exists between the old persons and the children. The actual value of a good gang of negroes is about 500 dollars per head. The loss occasioned by disease and usury on slaves, is more than compensated for by the natural increase of their number, which exceeds the losses by about 3 per cent. per annum

on an average. This is not the case in Cuba, &c., where the importation of slaves from Africa takes place, as there is but little, if any, increase, to compensate for the frightful mortality on the sugar plantations.

The slaves habituated to the cultivation of Georgia Sea Island cotton, are frequently sent to other districts, to be employed in the cultivation of upland cotton, wheat and rice, or in the construction of railways. For the latter work, 150 dollars per annum may be easily obtained for each full hand; the railway companies finding the food and clothes of the negroes.

The very fine qualities of Georgian long staple cotton can only be produced in the islands along the coast of Georgia and Carolina, or on such parts of the coasts as are under the influence of the saline vapours from the sea. The value of land adapted to this kind of cotton has considerably augmented during the last few years. An acre is now worth from 10 to 20 dollars, according to the situation and the fluctuation in the price of the cotton. All the islands where the Georgia long staple could perhaps be produced, are occupied by its cultivation, as well as the main land fringing the sea. The cultivation of the good kinds of ordinary Georgia long staple may still perhaps receive extension, to a moderate distance from the sea, but still under its influence, on the main land in Georgia, and also on the land bordering the sea in Florida.—*Bulletin de la Société Industrielle de Mulhouse*, No. 123, p. 287.

PROGRESSIVELY INCREASING DEARNESS OF BREAD AND MEAT.

The following interesting statistics, derived from the best official sources, showing the relative price of provisions in France at different epochs during the last 153 years, apply in a general way equally to these countries as to France. They present one of the most curious and important economical and social facts with which we are acquainted.

Increase for Bread.

From 1700 to 1763 the average price of 2lbs. of bread was	7½ centimes.*
" 1763 to 1812	10 "
" 1812 to 1846	15 "
" 1846 to 1853	20 "

Increase for Meat.

From 1700 to 1763 the average price of 2lbs. of meat was	25 centimes.
" 1763 to 1812	45 "
" 1812 to 1846	55 "
" 1846 to 1853	90 "

Thus from the year 1700 until the present time, the average price of bread has more than doubled, while that of meat has nearly quadrupled. And while the price of these different agricultural products has gone on increasing, we see that the price of all the products of manufacturing industry have gradually decreased. Thus cloths, and all woollen fabrics, have diminished by two-thirds; all fabrics of silk and cotton have fallen to the extent of three-fourths; iron itself has undergone a considerable diminution of price. Many articles of luxury and comfort have, like a vast number of other useful and necessary articles, also exhibited in their turn a remarkable fall from the prices at which they were formerly sold. It would be extremely interesting to compare the wages of the different classes of workmen at each of these periods, in order to see whether the labouring classes have gained or lost by the change. This would, however be a rather complicated question, as a great many elements would enter into the calculation.—*Le Genie Industriel*, Vol. VII. No. 39, p. 125.

* 100 centimes=1 franc=9·69 pence.

MÉMOIRE

SUR

LE SUCRE DE BETTERAVES;

Jean Antoine Coude,

PAR M. LE COMTE, CHAPTAL, *de Chantecoup.*

MEMBRE DE LA PREMIÈRE CLASSE DE L'INSTITUT
ROYAL, CHEVALIER DE L'ORDRE DU ROI, GRAND-
OFFICIER DE LA LÉGION D'HONNEUR, etc.

Lu à la première Classe de l'Institut royal de France, le
23 octobre 1815.



A PARIS,

DE L'IMPRIMERIE DE MADAME HUZARD

(née VALLAT LA CHAPELLE),

rue de l'Éperon-Saint-André-des-Arts, N°. 7.

1816.

MÉMOIRE

SUR

LE SUCRE DE BETTERAVES.

Résumé. 2-18-39 211 p 2-

LES vingt-cinq années qui viennent de s'écouler formeront une époque mémorable dans les Annales de l'industrie française. La plupart des événemens extraordinaires qui se sont succédés ont concouru à favoriser ses progrès. La France, privée de ses colonies, bloquée sur toutes ses frontières, s'est vue réduite à ses propres forces; et, en mettant à contribution les lumières de ses habitans et les productions de son sol, elle est parvenue à satisfaire à tous ses besoins, à créer des arts qui n'existoient nulle part, à perfectionner ceux qui étoient connus, et à s'affranchir des pays étrangers, pour la plupart des objets de sa consommation. C'est ainsi que nous avons vu successivement perfectionner le raffinage du salpêtre, la fabrication des armes et de la poudre, le tannage des cuirs, et la filature du coton, de la laine et du lin; améliorer le tissage des étoffes, et en exécuter plusieurs qui nous étoient étran-

gères ; décomposer le sel marin pour en extraire la soude ; former , de toutes pièces , l'alun et les couperoses ; fixer sur les tissus plusieurs couleurs qu'on regardoit comme *faux teint*, et remplacer le sucre de canne par celui de betterave , l'indigo de l'anil par celui du pastel , et l'écarlate de cochenille par la garance. On eût dit que les savans détournoient leur attention de dessus les misères publiques , pour ne la fixer que sur les moyens de soulager le peuple et d'alléger le fardeau de son infortune.

Quoique ces découvertes et beaucoup d'autres soient aujourd'hui des opérations de fabrique , il est à craindre que quelques-unes ne retombent dans l'oubli , ou par la facilité qu'on a de puiser aujourd'hui aux anciennes sources , ou par suite de l'habitude et des préjugés qui recommandent aux yeux du consommateur ce qui est usité depuis long-temps , ou enfin , par de fausses mesures en administration ; et je crois qu'il seroit extrêmement utile de décrire avec soin tous ces procédés , pour les confier à nos neveux. On verroit au moins ce qu'a pu la science pour la prospérité d'une nation dans un moment de crise ; et l'on en retireroit cette vérité consolante , c'est que la France peut se suffire à elle-même pour satisfaire à presque tous ses besoins.

Je me bornerai aujourd'hui à faire connoître comment la France est parvenue à suppléer au sucre du Nouveau-Monde par des produits de son sol ; et si l'Institut agrée ce travail , j'aurai l'honneur de lui soumettre successivement tous les nouveaux procédés de fabrication qui peuvent intéresser l'industrie , le commerce et la nation .

On se rappelle avec effroi ces temps difficiles où les Français , exilés des mers , n'avoient plus aucune communication , ni avec leurs colonies , ni avec celles des autres nations . La France se trouva privée tout-à-coup de tous les produits de l'Asie et de l'Amérique , dont la plupart sont devenus pour elle des objets de première nécessité . Elle fit un appel à l'industrie de ses habitants ; le Gouvernement encouragea leurs efforts , et , en peu de temps , on parvint à remplacer quelques produits par des produits indigènes , et à trouver , dans les productions de notre sol , des objets absolument de même nature que ceux qu'on avoit tirés jusque-là du Nouveau-Monde . Les cotons d'Espagne , de Rome et de Naples , surtout ceux de Castellamare , suppléoiént à ceux de l'Amérique et de l'Inde ; la garance remplaçoit la cochenille par le procédé de MM. *Gonin* ; le pastel , traité dans les ateliers de MM. *de Puy-maurin* , *Rouqués* et *Giobert* , fournissoit un

excellent indigo , et les nombreuses fabriques de sucre de betterave qui s'étoient formées , annonçoient à l'Europe qu'on étoit au moment de secouer le joug du Nouveau-Monde.

A peine ces établissemens ont-ils été formés , à peine les procédés , encore imparfaits , ont-ils été établis , qu'un nouvel ordre de choses a remplacé l'ancien : la paix a rouvert toutes nos communications , les habitudes ont repris leur empire , et peu s'en faut qu'on n'ait relégué au rang des chimères la possibilité de fabriquer chez nous le sucre et l'indigo. Cependant , quelques personnes ont continué et continuent à fabriquer du sucre de betterave ; et il est facile de prouver qu'elles peuvent soutenir cette fabrication concurremment avec celle des colonies ; c'est ce que je crois démontrer dans ce mémoire.

Lorsque la France a commencé à éprouver le besoin du sucre , on a d'abord cherché , dans les sirops de quelques fruits , sur-tout du raisin , le moyen d'y suppléer , et l'on a singulièrement amélioré cette fabrication. De grands établissemens se sont formés sur plusieurs points du royaume pour la fabrication des sirops , et ils ont produit deux grands résultats également avantageux : le premier , de verser dans la consommation une énorme quantité de sirops qui remplaçoient le

sucres dans plusieurs usages domestiques, et exclusivement dans les hôpitaux; le second, de donner de la valeur à nos raisins qui, à cette époque, n'en avoient presque aucune.

Peu de temps après, on a trouvé le moyen d'extraire un sucre farineux et solide du raisin, et ce produit a présenté plus d'analogie avec le sucre de canne que le sirop. Il étoit, comme lui, sans odeur, et pouvoit le remplacer dans tous ses usages, en l'employant à un poids double ou triple pour obtenir le même effet. Ce sucre n'est point susceptible de cristallisation.

A-peu-près dans le même temps, la chimie a fourni le moyen de décolorer le miel et de lui enlever son odeur; de telle sorte qu'on pouvoit l'employer, dans les infusions de thé et de café, comme le meilleur sirop de sucre.

Tous ces procédés étoient devenus des opérations de ménage, et on éprouvoit à peine quelque privation de la rareté du sucre de canne; mais il étoit réservé à la chimie de produire dans nos climats le véritable sucre des colonies; et c'est ce qui n'a pas tardé à arriver. Déjà les analyses de *Margraff* et les travaux si importants d'*Achard* sur l'extraction du sucre de la betterave avoient mis sur la voie; il ne s'agissoit plus que de perfectionner les procédés et de former des établis-

semens en assez grand nombre pour fournir à la consommation. A cet effet, les encouragemens ont été prodigués, et, en une année, on a vu se former plus de cent cinquante fabriques, dont quelques-unes ont obtenu de grands succès, et ont versé dans le commerce plusieurs millions d'excellent sucre. La plupart de ces établissemens ont dû échouer, sans doute, comme cela arrive pour tous les nouveaux genres d'industrie, soit parce que la localité est mal choisie, soit parce qu'on se livre à de trop grandes dépenses pour monter les ateliers, soit enfin parce qu'on n'opère pas avec assez d'intelligence.

Au milieu de ce vaste naufrage de fabriques, nous en voyons quelques-unes qui ont résisté et qui prospèrent depuis quatre ans. C'est dans celles-ci qu'il faut puiser les leçons d'une bonne pratique et d'une administration économique ; c'est là que nous trouverons les bons procédés, soit pour la culture de la betterave, soit pour l'extraction du sucre ; et, comme la mienne est de ce nombre, je me bornerai à citer mon expérience (1).

(1) M. *Deyeux* est le premier qui ait constaté en France les résultats que M. *Achard* obtenoit en Allemagne.

CHAPITRE PREMIER.

Culture de la betterave.

Les betteraves se sèment à la fin de mars, ou en avril, du moment qu'on n'a plus à craindre les gelées.

ART. I^{er}. *Choix de la graine.*

Il y a des betteraves blanches, il y en a de jaunes, de rouges et de marbrées, et quelquefois la pellicule est rouge, et la chair est blanche.

Il est aujourd'hui reconnu par les agriculteurs, sur-tout par ceux d'Allemagne, que la couleur ne se reproduit pas constamment, et que dans le produit d'un champ où l'on n'a semé que de la graine provenant de betteraves jaunes, par exemple, il s'en trouve plus ou moins de blanches ou de rouges ; c'est ce que j'ai eu occasion de vérifier moi-même.

En Allemagne, on donne la préférence à la betterave blanche ; en France on a préféré la jaune. Il m'a paru, d'après des expériences com-

paratives, qu'on donnoit trop d'importance à la couleur ; je n'ai pas observé que la variété des couleurs produisît une variété sensible dans les résultats, lorsque les betteraves provenoient du même sol et de la même culture.

ART. II. *Choix du terrain.*

Le terrain le plus propre à la betterave, paroît être celui qui est, à-la-fois, meuble et gras, et qui a de la profondeur.

Les terres maigres, sèches, sablonneuses, conviennent peu ; les betteraves y sont petites et sèches : elles donnent un suc qui marque jusqu'à onze degrés au pèse-liqueur de *Baumé*, mais qui est peu abondant. Il m'est arrivé de n'en extraire que 32 pour 100. Le suc est très-chargé de sucre ; mais la proportion ne dédommage pas le fabricant.

Les terres fortes, grasses, argileuses, ne conviennent pas non plus. Les graines y lèvent mal, sur-tout si, après les semences, il survient une forte pluie qui tasse la terre et ferme l'accès à l'air : alors la graine pourrit sans germer. J'ai perdu, en 1813, 10 hectares de betteraves par cet accident ; il est même rare que, dans ces terres fortes, la betterave acquière beaucoup de

grosneur : elle pousse en dehors , parce qu'elle ne peut pas se loger en dedans.

Les terres provenant du défrichement des prairies , les terres d'alluvion fumées et travaillées depuis long-temps , sont très-propres à la culture des betteraves.

Un bon terrain peut fournir jusqu'à cent milliers de betteraves par hectare ; j'en ai même récolté jusqu'à cent vingt sur un pré nouvellement défriché ; mais le produit moyen est de quarante à cinquante milliers.

ART. III. *Préparation du terrain.*

La terre destinée à recevoir des betteraves doit être préparée par deux ou trois labours très-profonds.

Depuis trois ans , je sème mes betteraves dans les terres qui doivent recevoir du blé en automne ; je les dispose par deux bons labours et un engrais convenable ; je sème vers la fin de mars , et arrache dans les premiers jours d'octobre. Je laisse les feuilles sur le terrain , sème le blé , et le recouvre par un labour ordinaire ; de cette manière ma récolte de betteraves est une récolte intermédiaire qui ne prive pas le domaine d'un grain de blé. Trois années d'expériences m'ont

prouvé que la récolte de blé étoit aussi bonne sur ces terrains , que sur ceux qui s'étoient reposés pendant l'été. Il y a plus , c'est que les sarclages et l'arrachement ont nettoyé le sol de toutes les plantes étrangères , et que les champs de blé en sont moins chargés que par-tout ailleurs.

On a cru, pendant quelque temps, que les terres fraîchement fumées produisoient des betteraves moins riches en sucre ; on a même ajouté que celles qui étoient fumées avec du fumier de mouton , ne donnoient que du salpêtre. Je puis affirmer que ces assertions sont erronées, et que la production du salpêtre tient à une autre cause que nous ferons connoître par la suite.

ART. IV. *Manière de semer.*

On a successivement employé quatre méthodes pour semer la graine de betterave : 1°. à la main ; 2°. au semoir ; 3°. à la volée ; 4°. en couche , ou pépinière.

1°. Pour semer à la main , on fait passer sur la terre labourée une herse armée de quatre à cinq dents , espacées d'un pied l'une de l'autre ; des femmes qui suivent la herse mettent des graines une à une dans les sillons que tracent les dents de la herse , en observant de les placer à une dis-

tance de 13 à 14 pouces l'une de l'autre ; on les recouvre ensuite avec des herbes d'épines.

Cette méthode a le double avantage d'économiser la graine , et d'espacer convenablement les betteraves pour qu'elles puissent se développer. Une femme peut , à la rigueur , en semer dix mille par jour ; et en général , quatre femmes peuvent semer un arpent ou un demi-hectare chaque jour. Un âne et un enfant suffisent pour promener la herse ; de sorte que cette méthode est très-économique.

2°. Dans la plaine des Vertus , aux environs de Paris , on a introduit depuis deux à trois ans l'usage du semoir.

Ce semoir consiste en un chariot , à l'essieu duquel sont fixées quatre à cinq roues en cuivre , d'un pied de diamètre , et placées à la distance d'un pied l'une de l'autre. Chacune de ces roues a trois petites cavités ou excavations sur sa circonférence. On a fixé une trémie dans laquelle on met la graine ; la circonférence des roues communique avec le fond de la trémie , et leurs cavités se chargent de graine en tournant ; mais comme les roues frottent , en sortant de la trémie , contre des morceaux d'étoffe , il ne reste qu'une graine dans leurs cavités , laquelle est versée sur le sol par le mouvement de rotation. La graine

est recouverte dès qu'elle tombe , par une palette fixée au chariot en arrière de l'essieu. Cette palette tranchante fait l'office de la herse, et découvre la terre à un pouce de profondeur.

Cette méthode est sans doute la plus économique ; on peut l'appliquer au blé avec un grand avantage. Un cheval et un enfant peuvent semer en un jour plusieurs hectares par ce procédé.

3^o. Il y a des cultivateurs qui commencent par semer en couche ou en pépinière , et qui transplantent ensuite les jeunes plants par repiquage. Cette méthode présente plusieurs avantages à l'agriculteur, en ce qu'il n'est pas détourné de ses opérations du printemps , pour les semences des blés de mars et des prairies artificielles, et qu'il ne s'occupe de transplanter ses betteraves que dans les premiers jours de juin, époque qui commence à devenir pour lui une saison morte ; mais elle offre des inconvéniens majeurs. Le premier de ces inconvéniens , c'est qu'il est bien difficile qu'en arrachant ces jeunes plantes très-tendres et cassantes , on ne laisse pas dans la terre la pointe de la queue de la betterave , et , dès-lors , elle ne plonge plus dans le terrain , sa surface se recouvre de radicules ou brindilles , et la betterave grossit sans s'allonger. Le second inconvénient attaché au repiquage , c'est qu'en plaçant la bet-

terave dans le trou qu'on a fait avec le plantoir , il est difficile que la pointe de la queue ne se replie pas ; et alors on éprouve tous les mauvais effets qu'on vient de signaler. Le troisième inconvénient, c'est que cette méthode est plus coûteuse que les autres ; et le quatrième enfin , c'est que le repiquage exige un temps pluvieux , ce qui ne se rencontre pas souvent , ou un arrosage artificiel , ce qui n'est pas possible dans toutes les localités.

Cependant , un repiquage partiel est très-souvent indispensable ; car il arrive quelquefois que les betteraves lèvent mal et inégalement , et il est alors avantageux de remplir les vides. Il est donc prudent d'avoir en réserve un semis de betteraves , pour pouvoir remplacer celles qui manquent.

4°. La quatrième méthode de semer les betteraves , consiste à les semer comme le blé , ou à la volée ; on recourt ensuite à la herse. Cette méthode , la plus simple de toutes , est en même temps celle à laquelle je donne la préférence ; à la vérité on emploie beaucoup plus de graine que par les autres procédés : il en faut environ trois kilogrammes , au lieu d'un et demi par arpent ; mais cette considération n'a presque plus de valeur depuis que le prix de la graine est descendu

à un taux raisonnable ; d'ailleurs , les avantages qu'on en retire sont immenses : 1°. en employant cette quantité de graine , on est à-peu-près sûr que tout le sol sera couvert ; 2°. dès que la plante est bien levée , on enlève par un premier sarclage toutes les betteraves inutiles , et on ne conserve que les pieds les plus vigoureux ; de sorte que , quelle que soit la saison , on est toujours sûr d'avoir une bonne récolte.

ART. V. *Des soins qu'exige la betterave pendant sa végétation.*

Il n'est peut-être pas de plante qui souffre plus du voisinage des herbes étrangères , que la betterave ; elle reste petite et sans vigueur , si la terre n'est pas soigneusement nettoyée de toutes les plantes qui poussent à ses côtés. Le sarclage est donc une opération indispensable ; il faut profiter , autant que cela se peut , du moment où la terre est humide : alors on arrache à la main toutes les plantes qu'on veut enlever , et elles ne se reproduisent plus ; mais si la terre est sèche , il faut recourir au sarcloir ou à la houe , et remuer la terre à 2 pouces de profondeur.

On doit renouveler le sarclage toutes les fois que la terre se couvre de plantes étrangères ; mais

en général deux opérations suffisent. C'est de l'argent bien placé que celui qu'on emploie au sarclage ; le produit d'un arpent bien sarclé est au moins double de celui qui ne l'a pas été.

ART. VI. *Arrachement des betteraves.*

En général, on arrache les betteraves dans le courant d'octobre ; on commence l'opération dès les premiers jours, et elle est terminée vers le 15.

On ne doit pas regarder l'époque où il convient d'arracher la betterave comme une chose indifférente ; celle que nous déterminons m'a paru la plus favorable pour les environs de Paris, et à une distance de 40 à 50 lieues de la capitale ; mais personne n'ignore que, dans l'acte de la végétation, il y a une succession de produits différens qui se forment et se remplacent les uns et les autres ; de sorte que l'existence du sucre cristallisable dans la betterave n'a qu'un temps, et c'est ce temps qu'il faut choisir pour arracher. Dans nos climats du midi ; par exemple, où la végétation est plus hâtive, vainement on a essayé d'extraire du sucre de la betterave arrachée en automne. Il paroît que, dans cette saison, l'époque de la saccharification est passée, et que le sucre s'est décomposé par les progrès de la végé-

tation, ou par une altération quelconque dans la betterave. Je puis citer à l'appui de mon opinion un fait bien constaté par M. *Darracq*, dont on connoît les talens et le bon esprit. Il y a trois ans que, de concert avec le préfet du département des Landes, M. le comte *D'Angos*, il forma le projet d'établir une sucrerie de betteraves. Dès le mois de juillet jusqu'à la fin du mois d'août, il fit l'essai de ses betteraves tous les huit jours, et constamment il en retira $3\frac{1}{2}$ pour 100 de beau sucre. Dès-lors, il se crut sûr du succès, et donna tous ses soins à former l'établissement sans continuer ses essais hebdomadaires; mais quelle fut sa surprise, lorsqu'en travaillant ses betteraves vers la fin d'octobre, il ne lui fut pas possible d'extraire un atome de sucre cristallisé!

Il paroît que, lorsque la betterave a terminé sa végétation *saccharine*, si je puis m'exprimer ainsi, il se forme du nitrate de potasse aux dépens des principes constituans du sucre; et cette formation a lieu dans la terre, lorsqu'elle est favorisée par la chaleur, tout comme dans les magasins: dans le mois de mars de 1813, je voulus exploiter des betteraves que j'avois enterrées dans une cave, et je n'obtins que du nitrate de potasse, quoiqu'elles ne fussent ni germées, ni

pourries ; ces betteraves me donnoient un tiers de moins de suc que celles qui avoient été gardées en plein air ou dans des magasins bien aérés.

Il n'est point rare de voir sortir des bouffées de gaz nitreux des écumes abondantes qui se forment lorsqu'on verse le suc de la betterave dans une chaudière (1) : la production de ce gaz annonce un commencement d'altération dans la betterave, quoique, dans cet état, on puisse en extraire encore du sucre ; j'ai observé plusieurs fois ce phénomène, et toujours dans les circonstances dont je viens de parler. Par les progrès de l'altération, ce gaz nitreux passe à l'état d'acide nitrique, cet acide s'unit à la potasse pour former des nitrates ; et, dès-lors, la décomposition du sucre cristallisable est complète.

Ne soyons donc plus surpris si, dans tout le midi, depuis Bordeaux jusqu'à Lyon, en opérant sur des betteraves qui avoient séjourné dans la terre jusqu'à la fin d'octobre, on n'a pu retirer que du nitrate de potasse, et pas un atome de sucre cristallisable.

A mesure qu'on arrache les betteraves, on les dépouille de leurs feuilles qu'on laisse, comme

(1) M. Barruel est, je crois, le premier qui ait observé ce phénomène.

engrais, sur le terrain, lorsqu'on n'a pas assez de bestiaux pour les consommer.

ART. VII. *Conservation des betteraves.*

Les betteraves craignent les gelées et la chaleur : elles gèlent à une température d'un degré au-dessous de zéro ; elles commencent à pousser et à s'altérer à une température de 8 à 9 degrés au-dessus de la glace fondante.

Les betteraves gelées donnent du sucre si on les travaille dans cet état ; mais elles fournissent beaucoup moins de suc. Lorsqu'elles sont dégelées, elles n'en fournissent plus.

Pour conserver les betteraves sans altération, il faut les placer dans un lieu sec et à une température qui ne soit que de quelques degrés au-dessus de zéro du thermomètre. Une grange, un grenier, sont des lieux très-propres à former un magasin de cette nature ; mais il est rare de pouvoir y loger tout l'approvisionnement d'une fabrique. A défaut d'un local couvert et assez spacieux, on est forcé de loger les betteraves en plein air, et, à cet effet, on choisit un sol sec et qui soit à l'abri des inondations ; on recouvre le sol d'une couche de cailloutage sur laquelle on met de la paille : on dresse dans le milieu

un piquet qu'on entoure, sur toute la hauteur, de bouchons de paille; on entasse les betteraves tout autour du piquet, et on en forme des carrés de 7 à 8 pieds sur 5 à 6 de hauteur. On enlève ensuite le piquet, de manière que l'espace qu'il occupoit devient une cheminée par où peuvent sortir les vapeurs qui s'échappent des betteraves. On recouvre ensuite les parois latérales et la sommité de la couche avec de la paille de seigle ou d'avoine. On a l'attention d'établir en pente la sommité de la couche, pour que la pluie ne puisse ni filtrer, ni séjourner; et l'on assujettit fortement la paille avec des liens pour la mettre à l'abri de la force des vents.

Il y a des cultivateurs, sur-tout dans le nord, qui, pour conserver leurs betteraves, les entassent dans les champs, les recouvrent de terre, et enveloppent le tout d'une couche de bruyère ou de genêts pour que l'eau n'y pénètre pas.

Mais, quelle que soit la méthode qu'on adopte pour emmagasiner les betteraves, il y a des précautions générales et indispensables à suivre, d'où dépend leur conservation :

1°. Il faut avoir l'attention de ne pas emmagasiner les betteraves mouillées; et, lorsque le temps le permet, il convient de les laisser dans

les champs, pendant quelques jours, pour qu'elles sèchent.

2°. Il ne faut recouvrir les betteraves que du moment qu'on est menacé d'une gelée, et avoir l'attention de les découvrir et de les laisser découvertes tant que la température est de quelques degrés au-dessus de la glace, pourvu toutefois qu'il ne pleuve pas.

3°. Il faut visiter souvent les betteraves ; et si on s'aperçoit qu'elles s'échauffent, qu'elles pourrissent ou qu'elles poussent, il convient de démonter le tas, d'enlever celles qui commencent à pousser ou à se pourrir, de même que celles qui pourroient être gelées, pour les travailler de suite, et de rétablir ensuite la couche,

CHAPITRE II.

De l'extraction du Sucre.

L'extraction du sucre de la betterave donne lieu à une suite d'opérations que nous allons décrire. Depuis quatre ans qu'on travaille la betterave en France , on a successivement employé beaucoup de procédés, et l'on a apporté de grandes modifications dans chacune des opérations ; je les ai tous vérifiés, je les ai tous comparés, et je me bornerai à décrire celui qui , constamment , m'a présenté les meilleurs résultats.

ART. I^{er}. *De l'épluchement des betteraves.*

Les betteraves qu'on transporte des champs sont plus ou moins chargées de terre , leur surface est plus ou moins couverte de radicules ; et , avant de les travailler , il faut les débarrasser de tous ces objets , et couper le collet qui ne contient pas sensiblement de sucre. Dans quelques fabriques , on enlève la terre par des lavages , et

on coupe les racines et le collet avec des couteaux ; mais le lavage est long et dispendieux ; il exige une grande quantité d'eau , et l'opération est difficile pendant les froids rigoureux de l'hiver (1).

J'ai supprimé le lavage dans ma fabrique , et je me borne à faire couper les collets et les racines , et à faire ratisser ou nettoyer la surface des betteraves avec un couteau : cette opération , qui s'exécute avec facilité par des femmes , coûte 12 sous ou 60 centimes par millier.

ART. II. *Extraction du suc de betterave.*

On extrait le suc de la betterave par deux opérations successives.

1°. On réduit la betterave en pulpe à l'aide

(1) Pour procéder économiquement au lavage des betteraves , on en met 100 à 140 livres dans un cylindre , dont le contour est en gros fil de fer ; la moitié du cylindre plonge dans l'eau d'une auge placée au-dessous ; on imprime un mouvement de rotation au cylindre. En peu de temps , les betteraves sont dépouillées de la terre qu'elles contiennent ; on élève alors le cylindre au-dessus de l'auge par le moyen d'un treuil : on ouvre une porte pratiquée sur la circonférence du cylindre , et les betteraves tombent et glissent sur un plan incliné qui les porte en dehors de l'auge.

de râpes mues à la main par le moyen d'un manège; les meilleures de ces râpes sont celles à cylindres, armés, à leur surface, de lames dentées; on imprime à ces cylindres un mouvement si rapide, à l'aide de l'engrenage, qu'ils font environ quatre cents révolutions sur eux-mêmes par minute; on présente la betterave à la circonférence, elle est déchirée et réduite en pulpe en un instant.

Deux de ces râpes, mues par le même manège et servies par trois femmes et deux enfans, peuvent suffire à une exploitation journalière de dix milliers pesant de betteraves, en opérant, deux heures le matin, de cinq à sept, et deux heures, depuis onze jusqu'à une heure après midi. Il est rare qu'on soit obligé d'employer deux heures et demie pour chaque opération.

Immédiatement après que l'opération de la râpe est terminée, les personnes qui y sont employées s'occupent à nettoyer les râpes, à les laver et à transporter, tout autour des râpes, les cinq milliers de betteraves qui doivent servir à une seconde opération.

Pour que la pulpe soit de bonne qualité, il faut qu'elle ne présente qu'une pâte molle, sans mélange de parties de betteraves non broyées; car la presse, quelque force qu'on lui suppose, ne

peut extraire qu'une faible portion de suc des fragmens de betterave qui n'ont pas été déchirés. Lorsqu'on se borne à écraser la betterave sous des meules, comme cela se pratique pour le cidre et le poiré, on n'obtient à la presse que 30 à 40 pour cent de jus, tandis que, lorsqu'on les déchire par les râpes, on en extrait 65 à 75 pour cent.

2°. A mesure qu'on forme la pulpe, on la soumet à la pression pour en extraire le suc : je commence par la soumettre à la pression de petites presses à levier, et j'en retire 30 à 40 pour cent de suc ; on porte ensuite le marc, ainsi exprimé, sous des presses beaucoup plus fortes qui en extraient encore autant, de sorte qu'on retire 65 à 75 pour cent de suc. L'opération est parfaite lorsque le marc est assez desséché pour que la main, en le pressant fortement, n'en soit pas mouillée.

On donne cette pression à l'aide de fortes presses à vis de fer, à l'aide de la presse hydraulique, des presses à cylindre ou de la presse à cric. On peut même employer à cet usage le pressoir de la vendange.

Pour diminuer les frais de la main-d'œuvre, j'ai placé mes râpes et mes presses au premier étage, de manière que le suc se rend de lui-même,

par des canaux de plomb, dans les chaudières qui sont au rez-de-chaussée.

Il convient d'exprimer la pulpe à mesure qu'elle se forme ; sans cela elle noitit, et il se développe un commencement de fermentation qui rend l'extraction du sucre plus difficile.

Le suc marque depuis 5 jusqu'à 11 degrés, et communément 7 à 8 au pèse-liqueur de *Baumé*.

Quatre hommes suffisent pour le travail des presses, en opérant sur dix milliers de betteraves par jour.

ART. III. *Dépuration du suc.*

Nous avons dit qu'à mesure que le suc couloit des presses, il se rendoit dans une chaudière que j'appelle *dépuratoire* par rapport à son usage. En supposant qu'on fasse deux opérations par jour, et qu'on travaille 5 milliers de betteraves chaque fois, cette chaudière, de forme ronde, doit avoir 5 pieds et demi de large sur 3 pieds 8 pouces de profondeur; dans ces dimensions, elle peut recevoir tout le produit d'une opération.

Dès que la chaudière est remplie au tiers ou à moitié, on allume le feu. Le suc a déjà pris une

chaleur de 40 à 50 degrés lorsqu'on a fini d'extraire le suc qui coule, sans interruption, des presses dans la chaudière; on porte alors la chaleur du bain à 65 ou 66 degrés; et, du moment qu'on a atteint ce degré, on étouffe le feu en le recouvrant de braise mouillée. On jette alors, dans la chaudière, de la chaux qu'on a fait fuser dans l'eau tiède, dans la proportion de deux grammes et demi (environ 48 grains) par litre de suc, en ayant soin de varier la proportion selon le degré de consistance du suc. On brasse la masse du liquide dans tous les sens pendant quelques minutes : alors, on ranime le feu pour porter la chaleur du bain à 80 degrés, c'est à-dire, jusqu'au degré le plus voisin de l'ébullition. On enlève alors le feu du foyer : il se forme, par le repos, une couche, à la surface du bain, qui, en demi-heure, acquiert de la consistance, et qu'on enlève soigneusement, avec l'écumoire, au bout de trois quarts d'heure. Dès qu'on a écumé, on ouvre un robinet qui est placé à un pied du fond de la chaudière, la liqueur coule d'elle-même dans une chaudière carrée : on ouvre ensuite un second robinet qui est placé au niveau du fond de la chaudière pour la vider en entier, et l'on fait tomber la liqueur sur un filtre d'où elle se rend dans la chaudière carrée.

ART. IV. *Formation des sirops.*

La chaudière dans laquelle se rend le suc épuré doit avoir 8 pieds de long sur 5 et demi de large, et 22 pouces de hauteur.

Dès que le fond de cette chaudière est couvert de liquide, on allume le feu, et on porte, le plus promptement possible, à l'ébullition.

Au moment où le bain entre en ébullition, on y verse de l'acide sulfurique délayé dans 20 parties d'eau, et dans la proportion du dixième de la chaux employée; on agite le bain pour que le mélange se fasse également : on peut employer avec succès les papiers teints avec le curcuma ou avec le tournesol pour s'assurer qu'il n'y a dans le bain ni excès de chaux, ni excès d'acide; il convient de laisser exister un excès de chaux, et ne plus employer d'acide du moment que la couleur du papier de curcuma ne prend plus dans le bain qu'une nuance de brique pâle ou de vin blanc foncé.

Après cette opération, on mêle à la liqueur trois pour cent de charbon animal bien broyé, en poudre impalpable; et, un moment après, on y ajoute une moitié du charbon qui a servi la veille (1).

(1) On a observé que le charbon provenant de la préparation du bleu de Prusse produisoit un meilleur effet que

ce mouvement en y jetant un atome de beurre , ou en modérant le feu.

On connoît que la cuite se fait bien , 1°. lorsqu'elle bout *sec* et avec bruit ; 2°. lorsque le sirop se détache de l'écumoire sans filer et sans adhésion ; 3°. lorsqu'en battant le bouillon avec le dos de l'écumoire , on entend un coup sec comme si on frappoit sur de la soie ; 4°. lorsqu'il ne se produit presque pas d'écume ; 5°. lorsqu'en prenant de la mousse ou des bulles sur le bouillon avec l'écumoire , les bulles disparaissent de suite et se résolvent en liquide : c'est ce dernier caractère qui sert à distinguer les bulles du bouillon de celles des écumes. On reconnoît encore une bonne cuite , toutes les fois qu'après avoir vidé la chaudière on n'aperçoit dans le fond aucune trace de noir , et que la surface paroît décapée.

On juge que la cuite est terminée d'après les signes suivans : 1°. on plonge l'écumoire dans le sirop , on la retire et on passe rapidement le ponce sur le bord pour prendre un peu de sirop ; on manie cette couche , entre l'index et le pouce , jusqu'à ce qu'elle ait la température de la peau ; alors on sépare rapidement les deux doigts ; lorsque la cuite n'est pas à son terme , il ne se forme pas de filet entre les doigts. Lorsqu'il commence à se former un filet , la cuite est bien avancée ,

et alors on répète souvent la même opération. La cuite est terminée du moment que le filet casse *sec* ; dans ce cas, la portion supérieure du filet se retire vers l'*index*, en formant une spirale, et ne rentre jamais en entier dans la masse qui adhère au doigt.

Dès qu'on reconnoît, par la *preuve*, que la cuite est à son terme, on couvre le feu, et, quelques minutes après, on la verse dans le *rafraîchissoir*, en ayant l'attention de verser de haut pour y mêler de l'air ; car l'on a reconnu que ce mélange d'air facilitoit la cristallisation.

La chaudière, qu'on appelle *rafraîchissoir*, est un vase dans lequel on réunit successivement toutes les cuites qui se font en un jour.

Le soir, lorsque toutes les cuites sont faites et réunies dans le *rafraîchissoir*, on en remplit les formes, qu'on appelle *bâtardes*. La cristallisation du sucre ne tarde pas à s'y opérer ; et, presque toujours, elle est complète le lendemain, de manière que vingt-quatre ou quarante-huit heures après la *mise en formes*, on peut, sans inconvénient, porter les formes sur les pots pour faire couler la mélasse.

On reconnoît une bonne cristallisation lorsque la surface est sèche, que la pâte est bien grenée et point sirupeuse, et lorsque la surface de la base

du pain de sucre se crevasse et se déprime vers le milieu , ce qui est connu sous le nom technique de *fontaine*.

Je passe sous silence plusieurs petits détails de procédé , dont la description ne feroit qu'arrêter ma marche , et qui , d'ailleurs , sont inutiles ou superflus , parce qu'ils ne sont ignorés d'aucune personne qui se soit tant soit peu occupée de ces objets.

Je terminerai cet article par observer que , pour ne rien perdre dans les ateliers de sucrerie , on soumet à l'effort d'une presse à levier les écumes , les résidus des filtres et le dépôt des chaudières , pour en exprimer tout le suc qui y est contenu , et qu'on le verse à mesure dans les chaudières , pour y suivre le cours des opérations.

Une observation très-importante , et qu'il ne faut pas négliger , c'est qu'on doit se presser de travailler le suc de la betterave à mesure qu'on l'extrait : si on le laisse reposer plusieurs heures , sur-tout quand il n'est pas concentré , il éprouve des altérations qui dénaturent le sucre , rendent son extraction plus difficile , et diminuent notablement la quantité.

ART. VI. *Du raffinage.*

Je ne m'étendrai pas beaucoup sur le raffi-

nage du sucre ; les procédés en sont connus et bien décrits : je ne me permettrai que quelques détails sur les perfectionnemens qui y ont été apportés , de nos jours , par les personnes qui se sont occupées de l'extraction du sucre de betterave.

M. *Derosne* a proposé , le premier , de raffiner à l'alcool ; et ce procédé , qui est très-expéditif , convient d'autant mieux à une sucrerie de betteraves , qu'il dispense d'une foule d'ustensiles nécessaires dans l'ancien procédé.

Lorsqu'on veut raffiner à l'alcool , il faut avoir l'attention de procéder au raffinage , du moment qu'on a fait couler la mélasse ; car si on donne le temps au sucre de se dessécher , la mélasse qui en humecte les cristaux s'épaissit ; elle forme une couche très-dure sur la surface des cristaux , et l'alcool la détache avec beaucoup de peine.

En partant de cette observation , on procède au raffinage comme il suit : du moment que la mélasse est écoulée , on ratisse la surface du pain de sucre contenu dans la forme , et on verse , peu à peu , sur toute l'étendue de la surface , un litre d'alcool à 36 degrés du commerce , après avoir bouché le petit orifice de la forme. On recouvre alors la base de la forme avec soin pour éviter l'évaporation de l'alcool. Deux heures

après, on ouvre l'orifice de la forme, et l'alcool coule dans le pot, chargé d'une grande partie du principe colorant; on peut répéter l'opération avec moitié de nouvel alcool, et le sucre équivalait alors, pour la blancheur, au sucre terré ou à de la belle cassonade. Alors, on fond le sucre et on le travaille à la chaudière avec le sang de bœuf. On termine l'opération, ou en le terrant, ou en l'alcoolisant; mais on a observé que, par le dernier de ces moyens, le sucre conservoit un coup d'œil plus mat que par le premier, et qu'il étoit un peu plus friable; voilà pourquoi je fais la première opération par l'alcool, et la seconde par le terrage.

Les pains de sucre alcoolisés conservent de l'odeur pendant quelque temps; mais cette odeur disparoît par le séjour des pains à l'étuve et même par la simple exposition au grand air.

Il est nécessaire d'employer l'alcool concentré à 36 degrés; lorsqu'il est plus foible, il dissout une portion de sucre.

La totalité de l'alcool n'est pas perdue: il suffit de le distiller pour le dépouiller de la mélasse qu'il a entraînée; et alors on peut le faire servir de nouveau.

On a proposé une autre méthode de raffiner le sucre, qui ne m'a pas paru réunir les avantages

de celle que je viens de décrire, pas même ceux de l'ancienne : elle consiste à dissoudre cent parties de sucre brut, et à les traiter avec 10 pour 100 de charbon et dix blancs d'œufs. Lorsque le pain est dans la forme, on fait couler à travers, un et demi pour 100 de sirop blanc.

CHAPITRE TROISIÈME.

COMPTE rendu , par dépenses et produits , d'une fabrication de sucre de betteraves.

Le procédé que je viens de décrire me paroît le plus sûr, le plus économique et le plus simple de tous ceux qui sont parvenus à ma connoissance; mais, si le prix du sucre qui en est le produit étoit supérieur à celui du sucre du commerce provenant du Nouveau-Monde, ce seroit tout au plus un nouveau fait pour la science et un objet de pure curiosité pour la société. Nous allons donc présenter un état très-exact de la dépense et de la recette, pour mettre chacun à portée de juger de l'importance de cette nouvelle branche d'industrie.

ART. 1^{er}. *De la dépense.*

La dépense se compose : 1°. du prix de la betterave; 2°. de la main-d'œuvre pour l'extraction du sucre; 3°. de l'intérêt de la mise de fonds

pour former l'établissement; 4°. de l'entretien des machines et usine; 5°. de l'achat du combustible, charbon animal et autres petits objets employés dans la fabrique.

La betterave se vend généralement 10 fr. le millier. A ce prix, l'agriculteur y a trouvé, jusqu'ici, un bénéfice raisonnable, sur-tout lorsqu'elle est cultivée dans de bons terrains.

En supposant une terre de qualité moyenne, mais propre cependant à produire du blé, on peut calculer ce que coûte la betterave, d'après les bases suivantes. Nous nous bornerons à faire le calcul sur la culture d'un arpent.

1°. Loyer d'un arpent	20 f.
2°. Deux labours profonds	24
3°. Deux sarclages	20
4°. Achat de graine	3
5°. Semence et hersage	22
6°. Arrachement et transport.	40
7°. Engrais.	50
8°. Impositions.	5

TOTAL.	<u>184</u>
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Ici nous ferons supporter tous les frais à la betterave, quoique nous ayons observé que les terres qui leur étoient consacrées fussent semées en blé vers le 15 octobre, après qu'on a arraché

les betteraves, et que nous pussions faire partager au blé les frais des deux labours, du loyer, des impositions et du fumier. On sentira, d'après cela, qu'on pourroit réduire d'un tiers les dépenses que nous passons sur le compte des betteraves.

On évalue généralement le produit moyen d'un arpent de betteraves à 20 milliers; ce qui établit le prix du millier pour l'agriculteur à 9 fr. 20 c.; mais, comme l'épluchement ôte près d'un dixième à la betterave, les 20 milliers se trouvent réduits à 18 lorsqu'elle entre en fabrication : nous porterons donc le prix de la betterave à 10 fr. le millier pour le fabricant, en supposant toujours qu'il n'emploie que le produit de sa propre récolte.

Pour déterminer à présent les autres frais et avoir rigoureusement l'état de la dépense, nous supposerons qu'on travaille 10 milliers de betteraves épluchées par jour.

1°. 10 milliers de betteraves.	100 f.
2°. Deux chevaux et un homme au manége.	9
3°. Cinq femmes aux râpes.	3
4°. Quatre hommes aux presses.	6
5°. Deux hommes aux chaudières.	3
6°. Charbon animal	10
7°. Acide, chaux et sang de bœuf	2

Ci-contre. . . . 133 f.

8°. Perte sur l'alcool employé au raffinage. 4

9°. Combustible 12

Comme nous supposons que la fabrique ne travaille que quatre mois de l'année, il convient de répartir, sur ces quatre mois, des dépenses d'une autre nature, telles que l'intérêt de la mise de fonds, l'entretien des ustensiles, le salaire du maître raffineur, etc. Ainsi, en supposant que l'établissement coûte 30,000 fr., ce qui est le *maximum* pour une fabrication de 10 milliers par jour, l'intérêt de la mise de fonds réparti sur 120 jours de travail, fait par jour. 16

Entretien des ustensiles et de l'usine. . 10

Salaire du raffineur et de l'ouvrier qui lui est attaché. 20

Menues dépenses. 5

TOTAL. 200

La dépense de chaque jour pour l'exploitation de 10 milliers de betteraves est donc de 200 fr.

ART. II. *Du produit d'une exploitation de
10 milliers de betteraves par jour.*

Le produit de la fabrication se compose de
trois objets distincts :

- 1°. Le sucre.
- 2°. Le résidu ou marc des betteraves.
- 3°. La mélasse.

En général, la betterave fournit de 3 à 4 pour
100 de sucre brut; il y a même des fabriques qui
en ont retiré de 4 à 5. La quantité varie en raison
des chaleurs plus ou moins constantes de l'été,
et sur-tout en raison de l'intelligence qu'on a
apportée dans les travaux de fabrication.

Nous supposerons qu'on n'en extrait que 3 pour
cent. Dix milliers de betteraves exploitées par
jour, donneront donc 300 livres de sucre brut
qui, à raison d'une dépense de 200 fr. par jour,
portent le prix du sucre brut à environ 13 sous
ou 65 cent. la livre.

Indépendamment du produit du sucre, il en
est un second qui mérite une grande considéra-
tion, ce sont les épluchures, et le marc des bette-
raves après qu'on en a exprimé le suc.

Les épluchures forment, à - peu - près, le
dixième du poids de la betterave; elles sont
composées des collets, des racines, de quelques

portions de la peau et de la terre qui peut adhérer à la surface. Sur un millier d'épluchures provenant de 10 milliers de betteraves, il y a au moins une bonne moitié qui fait une excellente nourriture pour les cochons, qui en sont très-avides.

Le marc des betteraves forme un objet bien plus important. En supposant qu'on extraie 70 pour 100 de suc de la betterave, l'exploitation de 10 milliers par jour fournit 1500 kilogrammes, ou environ 30 quintaux de marc, qui forment une nourriture très-précieuse pour les bêtes à cornes.

Cette nourriture, qui est presque sèche, n'a ni les inconvénients des herbes ou racines aqueuses, ni ceux des fourrages secs pour l'usage des bêtes à cornes; elle ne produit point la pourriture comme les premières, et ne donne pas lieu à des obstructions, ni n'échauffe pas comme les seconds; elle contient presque tous les principes nutritifs de la betterave dont on n'a enlevé, en la travaillant, qu'environ 60 pour 100 d'eau, 3 pour 100 de sucre, et un peu d'extractif et de gélatine.

Cette quantité de marc peut nourrir, par jour, 7 à 800 bêtes à laine.

Les bœufs, les vaches, la volaille, dévorent cette nourriture, qui les engraisse beaucoup mieux.

que tous les alimens connus; les brebis et les vaches laitières soumises à ce régime, donnent beaucoup plus de lait, et d'une excellente qualité.

Dans un domaine où l'on établiroit une fabrique de l'importance de celle dont je parle, on peut engraisser, par an, 50 à 60 bœufs ou 4 à 500 moutons avec ces seuls résidus.

La mélasse est un troisième produit qui n'est pas à dédaigner. L'exploitation d'un millier de betteraves en fournit à-peu-près 240 livres par jour, qu'on peut vendre dans le commerce à raison de 10 à 15 fr. le quintal ou les 50 kilogrammes, ou bien les faire fermenter et les distiller pour en extraire l'alcool.

Lorsqu'on prend le parti de distiller, on délaye la mélasse dans l'eau, de manière que la liqueur marque 7 à 9 degrés; on y mêle ensuite avec soin de la levure de bière ou du levain de pâte d'orge délayés dans l'eau tiède, dans la proportion de 2 livres pour la première, par 10 quintaux de liquide, et de 6 livres pour la seconde.

Les cuiviers qui contiennent cette liqueur à fermenter, doivent être placés dans une étuve où la chaleur soit constamment à 16 ou 18 degrés du thermomètre centigrade. La fermentation ne

tarde pas à s'annoncer, et elle est terminée en quelques jours.

La distillation doit s'opérer dans les alambics perfectionnés d'*Adam* et de *Berard*; alors l'alcool n'a aucun mauvais goût, et on peut l'obtenir au degré qu'on désire par une seule distillation. Cet alcool a cela de particulier, c'est qu'au même degré de concentration il est infiniment plus piquant que tous les autres qui nous sont connus.

100 litres de mélasse donnent à - peu - près 33 litres d'alcool à 22 degrés.

Avant de livrer les résidus aux bestiaux, on peut les faire fermenter en les délayant dans une quantité d'eau suffisante, et les distiller ensuite. Par ce moyen, on peut encore en extraire environ 4 pour 100 d'alcool; mais cette opération entraîne un embarras de manipulation qui me l'a fait abandonner; elle a donné lieu, néanmoins, à une observation que je ne puis pas passer sous silence, pour éclairer ceux qui pourroient se trouver dans le même cas que moi. J'avois conçu l'idée de passer de l'eau sur les résidus pour m'en servir ensuite à délayer la mélasse; cette eau de lessive marquoit de 2 à 4 degrés; je procédois ensuite à la fermentation par la méthode ordinaire. La fermentation s'établissoit facilement: lorsqu'elle étoit terminée,

de l'alcool par la fermentation , mais différant entre elles par des propriétés particulières. L'état sous lequel se présentent ces trois espèces de sucre établit et constitue une de leurs principales différences : l'une est constamment à l'état liquide, l'autre à l'état d'une poudre qui n'est pas susceptible de cristallisation, et l'autre à l'état de cristaux très-réguliers.

La première espèce, ou le sucre liquide, existe dans la plupart des végétaux et des fruits ; elle constitue les sirops lorsque le suc est convenablement rapproché par l'évaporation.

La seconde espèce se présente sous forme solide et sèche, mais sans être susceptible de cristallisation ; le sucre de raisin est de ce genre, de même que le sucre du miel et celui qui provient de l'altération de l'amidon par l'acide sulfurique.

La troisième espèce est susceptible de cristalliser ; et les cristaux présentent la forme d'un prisme tétraèdre, terminé par un sommet dièdre. Cette dernière espèce se trouve dans la canne à sucre, la betterave, l'érable à sucre, la châtaigné, la châtaigne d'eau, etc. Cette dernière espèce est la plus estimée et la plus recherchée, 1°. parce qu'elle a un goût plus franc ; 2°. parce que, sous le même poids, elle sucre davantage ; 3°. parce

qu'elle est plus facile à employer et plus agréable à la vue.

Il n'existe pas aujourd'hui le moindre doute , dans l'esprit des hommes éclairés , sur la parfaite identité des sucres qui constituent la troisième espèce ; et lorsqu'on les a ramenés , par le raffinage , au même degré de blancheur et de pureté , la personne la plus prévenue ne peut y trouver aucune différence.

Sans doute , lorsque , dès le commencement de la fabrication , on a versé dans le commerce des sucres de betterave brûlés , mal préparés , mal raffinés , le consommateur a dû les proscrire et trouver , entre ces sucres et ceux de Hambourg ou d'Orléans , une très-grande différence ; mais , alors même , l'homme instruit les a confondus dans la même espèce , et il a rapporté cette différence à l'imperfection du procédé naissant plutôt qu'à la nature des principes. Déjà notre célèbre collègue M. *Havy* avoit prouvé que la forme des cristaux étoit la même ; déjà plusieurs fabriques présentoient des résultats analogues à ceux des colonies , et il étoit naturel de penser que la même perfection s'établirait peu - à - peu dans tous les ateliers. On savoit que , de tout temps , on a fabriqué des draps avec les mêmes matières , et que néanmoins les draps du dixième

siècle n'étoient pas comparables à ceux du dix-huitième; on savoit que chaque art a son enfance, mais qu'aujourd'hui cette enfance est de peu de durée par rapport aux progrès des lumières. Ce qu'on avoit prédit est arrivé; et, en moins de deux ans, la fabrication s'est améliorée; elle s'est simplifiée au point qu'elle est aujourd'hui confiée à des ouvriers, et qu'il y a peu d'opérations qui présentent des résultats plus sûrs et plus constans : aussi, les produits des fabriques de betteraves circulent-ils dans le commerce sans opposition, et le consommateur y met le même prix qu'à ceux de cannes de qualité égale.

On a dit que ce sucre étoit plus léger que celui de cannes, et que, par conséquent, sous le même volume, il sucroit moins : quelque foible que soit cette accusation, il m'est impossible d'y souscrire : j'emploie les mêmes formes qu'à Orléans, et chacune fournit un pain rigoureusement du même poids que dans les raffineries d'Orléans. Depuis trois ans je n'emploie pas à ma table d'autre sucre que celui de ma fabrique, et il est peu de jours où des convives, qui ne s'en doutent pas, ne me fassent compliment sur la beauté et la bonté de ce sucre.

J'ai déjà observé que le sucre raffiné à l'alcool exhale, pendant quelque temps, une odeur

désagréable ; ainsi , si on le met dans le commerce immédiatement après qu'il est raffiné , le consommateur sera en droit de se plaindre , et de le repousser ; ici c'est la faute , non du sucre , mais du propriétaire , qui doit laisser disparaître cette odeur d'alcool avant de le mettre en vente.

Ainsi le sucre de betteraves et celui de cannes sont rigoureusement de même nature , et on ne peut établir entre eux aucune différence.

ART. II. *Avantages que l'agriculture peut retirer des sucreries de betteraves.*

L'agriculture ne peut que retirer un très-grand avantage de ces établissemens : tout ce qui varie les récoltes et en augmente le nombre , est un bienfait pour l'agriculture ; ainsi , sous ce rapport , la culture de la betterave lui est avantageuse : cette culture fournit en outre un moyen d'assolement de plus ; et , en en faisant une récolte intermédiaire , ainsi que je le pratique , elle double le produit du fonds et ne fait pas perdre un grain de blé.

La culture de la betterave a encore l'avantage de rendre la terre plus meuble , et de la nettoyer des mauvaises herbes par les sarclages.

La fabrication du sucre de betteraves n'est pas moins utile à l'agriculture que la culture de cette plante.

1°. Les résidus ou le marc des betteraves peuvent fournir à la nourriture des bêtes à cornes et des cochons d'un grand domaine pendant quatre mois d'hiver, novembre, décembre, janvier et février.

En supposant qu'il y eût en France deux cents fabriques travaillant dix milliers de betteraves par jour, les résidus suffiroient à l'engrais de dix à douze mille bœufs ou de quatre-vingts à cent mille moutons, et de deux à trois mille cochons.

2°. Ces fabriques ont l'avantage d'occuper les chevaux et les hommes d'un domaine pendant la morte saison, et de donner du travail à des étrangers qui, durant ces quatre mois, seroient condamnés à l'oisiveté. Indépendamment des hommes employés à la culture de la betterave, l'épluchement et l'extraction du sucre pourroient occuper les bras de cinq à six mille personnes pendant l'hiver, en supposant qu'il y eût deux cents fabriques en activité.

ART. III. *Est-il de l'intérêt de la France de multiplier les fabriques de betteraves?*

La France ne peut pas avoir d'autre intérêt

que celui de ses habitans ; ainsi tout ce qui augmente la masse du travail , tout ce qui multiplie les productions de la terre et de l'industrie , tout ce qui enrichit l'agriculteur , ne peut que mériter une grande protection de la part de son Gouvernement.

Ici se présente , sans doute , la grande considération des colonies , et je n'ai point la prétention de résoudre une question d'une aussi haute importance : je me bornerai à présenter , à ce sujet , quelques vues que je sou mets avec respect à la sagesse du Gouvernement et aux hommes plus éclairés que moi.

Je ne dirai point , avec quelques écrivains , que le système colonial n'intéresse pas la nation , sous le prétexte que les colonies ne versent rien au trésor public , qu'elles sont une occasion de guerre toujours existante , qu'elles nécessitent l'entretien d'une marine très-dispendieuse , etc. Je sais que les colonies ouvrent un débouché aux produits de notre industrie et de notre sol ; je sais qu'elles alimentent nos fabriques en matières premières , et qu'elles donnent une grande activité au commerce : sous tous ces rapports , les colonies ont été jusqu'ici une des sources principales de la prospérité publique ; mais , si tous ces avantages peuvent être reportés dans le sein même

de la France , si la fabrication indigène du sucre et de l'indigo peut remplacer le sucre et l'indigo du Nouveau-Monde , au même prix et dans les mêmes qualités ; si cette nouvelle industrie augmente la masse du travail parmi nous , et enrichit notre agriculture sans la priver d'aucun de ses produits ; il est évident qu'il reste , contre les colonies , sans compensation d'aucun intérêt majeur , les dépenses annuelles qu'elles occasionnent et les nombreuses chances de guerre qui , tout à coup , compromettent nos fortunes et nous forcent à des privations , lorsqu'une marine formidable ne peut pas dominer ou au moins rivaliser sur les mers.

On pourroit fortifier ces raisons , de l'état actuel des colonies : mais à Dieu ne plaise que je prétende détourner l'attention du Gouvernement d'un aussi grand intérêt pour la métropole , et de sa sollicitude paternelle pour les malheureux colons qui ont été dépouillés de leurs propriétés ! Je me borne à désirer , pour le moment , qu'il encourage les établissemens de sucre indigène , pour que leurs produits concourent avec ceux des colonies , et que nous puissions reprendre , avec les étrangers , des relations commerciales qui se bornoient à l'échange de nos denrées coloniales , sur-tout du sucre , contre les

productions de leur sol. Cela devient d'autant plus important, que nos principaux rapports de négoce avec Hambourg et les peuples du nord, consistoient en denrées coloniales, qu'ils nous payoient en bois de construction, métaux, potasse, chanvre, lin et suif, et que, ces grands moyens d'échange venant à nous manquer, l'Angleterre doit hériter de cet immense commerce.

ART. IV. *Des causes qui ont déterminé la chute de la plupart des établissemens qui s'étoient formés.*

Les hommes qui ne jugent les arts que superficiellement, se persuadent que les fabriques de sucre de betterave ne peuvent pas soutenir la concurrence des fabriques de sucre de canne, et ils appuient aujourd'hui leur opinion sur la chute de la plupart des établissemens qui s'étoient formés avant la paix. On pourroit se borner à leur répondre, qu'il suffit que quelques-uns se soutiennent, malgré la concurrence des sucres étrangers, pour prouver que nos fabriques peuvent rivaliser; mais je préfère indiquer ici les causes de cette chute, et établir quelques principes qui puissent diriger les entrepreneurs dans les nouveaux établissemens qui pourront se former.

Lorsqu'on a commencé à extraire du sucre de la betterave, le Gouvernement a excité le zèle de tous les Français par des encouragemens ; par-tout on a semé des betteraves, par-tout on a formé des établissemens sans consulter préalablement, ni l'avantage du sol, ni le prix de la culture, ni la qualité saccharine de la racine. On a bâti, à grands frais, de vastes ateliers ; on a acheté des râpes et des presses dont on ignoroit l'effet ; et souvent on est arrivé au moment de la fabrication sans se douter du procédé qui seroit mis en usage, quelquefois même sans avoir fait choix d'un homme capable de conduire les opérations.

La marche raisonnée d'une nouvelle industrie n'est point celle qu'on a suivie : on a fait des pertes, et on devoit s'y attendre. Ici la betterave ne contenoit plus de sucre au moment où on l'a travaillée : c'est ce qui a entraîné la chute de tous les établissemens du midi ; là, on a employé de mauvais procédés, et on n'a extrait que des sirops ; ailleurs, la culture, ou l'achat de la betterave, ont été si coûteux, que le produit n'a pas balancé la dépense.

Cette manière irréfléchie de procéder a dû entraîner la chute de la plupart des établissemens ; et, comme on raisonne d'après les résultats de

son expérience, qu'elle soit bonne ou mauvaise ; il s'est bientôt formé une opinion presque générale contre le succès de nos fabriques. D'un autre côté, la mauvaise qualité du sucre que quelques fabricans ont versé dans le commerce, n'a pas peu contribué à dégoûter le consommateur.

Il eût mieux valu, sans doute, rechercher les causes de ce peu de succès, et tourner les yeux vers les établissemens qui prospéroient, pour y étudier la bonne méthode ; mais telle n'est pas la marche de l'opinion publique, en fait d'industrie ; elle adopte souvent une nouveauté sans examen, comme elle la proscriit sans raison plus souvent encore.

Néanmoins, les essais, répétés sur tous les points de la France, ont présenté des résultats dont l'observateur a pu faire son profit ; et ces essais nous ont enfin amenés à des connoissances positives sur la culture de la betterave, sur son produit et sur un procédé sûr, facile et économique, pour en extraire tout le sucre.

L'expérience nous a encore appris que les établissemens de sucre de betterave ne pourroient prospérer qu'entre les mains des propriétaires qui récolteroient eux-mêmes les betteraves, et consommeroient les résidus dans leurs domaines. Il suffit, en effet de jeter un coup d'œil sur les avan-

tages que présente cette fabrication, liée à une grande exploitation rurale, pour sentir combien doit être grande la différence des résultats dans les deux cas.

1°. Le propriétaire qui cultive la betterave, l'obtient à plus bas prix que l'entrepreneur qui l'achète au cultivateur ; cette différence est immense, sur-tout si on considère que cette récolte étant intermédiaire, les frais de labour et de fumier peuvent être supportés par la récolte du blé qui succède.

2°. Les résidus de betteraves peuvent nourrir presque toutes les bêtes à cornes d'un grand domaine, pendant les quatre mois les plus rigoureux de l'année : la vente de ces résidus ne produit pas à l'entrepreneur la moitié du bénéfice qu'en retire l'agriculteur en les consommant dans sa ferme.

3°. Les transports, le travail du manège et la plupart des opérations dans l'atelier, s'exécutent par les chevaux et les hommes de la ferme ; tandis que l'entrepreneur est obligé de tout créer, d'appeler tout du dehors, et cela, pour un temps limité, ce qui lui donne encore plus d'avantages.

4°. La main-d'œuvre est plus chère dans les villes où s'établit l'entrepreneur, que dans les campagnes où réside le propriétaire.

5°: Le combustible coûte constamment un peu plus dans les villes que dans les campagnes, surtout le bois; et quelques-unes des opérations peuvent être conduites avec ce combustible.

Ainsi ce nouveau genre d'industrie doit être établi dans les grands domaines; c'est là, et là seulement, qu'il peut obtenir une grande prospérité. Indépendamment des avantages que présentent ces localités, nous pourrions ajouter qu'il est rare que les bâtimens dépendans d'une grande exploitation rurale ne présentent pas assez de développemens pour y fixer, sans frais de construction, cette nouvelle industrie. Je pourrais citer à l'appui deux établissemens de ce genre, qui n'ont pas exigé une dépense de 300 francs en construction, pour être annexés aux domaines; et ces deux établissemens prospèrent dans le moment actuel; ils viennent de rouvrir leur cinquième campagne.

Le grand propriétaire, accoutumé jusqu'ici à des récoltes faciles, se livrera peut-être encore difficilement à cette nouvelle exploitation, parce qu'elle suppose des connoissances qu'il n'a pas. Mais qu'il considère que nous avons fait tous les frais des tâtonnemens, que les procédés que nous venons de décrire sont faciles et sûrs, que les calculs que nous avons établis sont exacts et déduits de l'expérience; qu'il considère que les dis-

tilleries de grain et de pommes de terre , formées dans presque tous les domaines du nord , exigent des connoissances presque aussi étendues , sans présenter néanmoins autant d'avantage, puisque , outre la nourriture des bestiaux et le produit de l'alcool , plus abondans par les betteraves que par le grain , nous avons , de plus que dans ces distilleries , la production du sucre ; et l'on verra qu'on peut à-la-fois améliorer son domaine et concourir à enrichir son pays d'un produit qui est devenu pour lui de première nécessité.

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FIN.

THE

JOURNAL OF INDUSTRIAL PROGRESS.

No. VII.—JULY, 1854.

ART. I.—*On the Manufacture of Beet-root Spirit.*

THE disease which has attacked the vine in France, especially during the autumn of 1853, so affected the produce that the manufacture of brandy fell off very considerably, and its price consequently rose. In several parts of the north of France, on the other hand, the crop of beet was rather inferior, and not well adapted for the production of sugar. These two circumstances have caused a great number of manufacturers to turn their attention to the subject of the production of spirit directly from the beet. Experience has shown that roots may be very unfit to be profitably used in the manufacture of sugar, and yet be rich in that substance. Now if this sugar could be converted into alcohol, it might give rise to the creation of a new branch of trade. That can now be done by a process as simple, as it is ingenious and economical. We alluded to this process in the first number of this Journal, and drew attention to its importance with reference to this country.* It has since then been fully tested, and its value placed beyond all doubt; whilst from an Irish point of view, circumstances have arisen which appear to us to recommend it strongly to the serious consideration of Irish capitalists. It is now quite evident that the Chancellor of the Exchequer has come to the determination of equalizing the duties upon spirits in England, Scotland, and Ireland. If this be done, there can be no doubt that the increase of price, caused by the elevation of the duty upon whiskey in this country, will cause a corresponding decrease in the consumption of spirits, and the Irish distilling trade will be materially injured, inasmuch as the Irish distiller will not be in a position to compete with a large majority of the British distillers.

Very little raw spirit is consumed in England, the greater part being first rectified, to free it from the peculiar oils which give the flavour to corn spirit, and is then prepared in various ways to suit the public taste. The worst spirit, or, in other words, the spirit prepared from the cheapest

* See Journal of Industrial Progress, No. I. p. 25.

materials, made on the largest scale, and with the most improved form of still, will be just as good as the very best Irish whiskey. The English manufacturer has therefore to consult economy alone, whilst the Irish distiller, the greater part of whose produce is consumed raw, has hitherto been obliged to consult the taste of his customers rather than economy of production. The natural result of this has been, that judged from the latter point of view alone, our system of distillation, in all its details, is very far behind that of England. As an example, we may take our stills, which cannot be compared for a moment with that admirable apparatus, Coffey's still. The latter is now very largely used in England, or some other improved one upon analogous principles, whilst we believe there is not a single one worked at present in Ireland, although the inventor was an Irishman. Those which had been put up having been found to produce a spirit unfit for consumption in its raw state, were obliged to be given up.

When the duties come then to be equalized, the Irish home trade will be reduced, and the Irish distiller will in most cases be unable to take advantage of the demand for inferior spirits in England. The introduction of the manufacture of beet-spirit would hence be of eminent service to Ireland, for, while it would not interfere with the manufacture of ordinary corn whiskey for consumption in its raw state, it could be made at so low a price as would enable its manufacturers to undersell those of every other spirit for rectification. With a view of again directing attention to the matter, we shall give a short history of the attempts which have from time to time been made to devise a simple process of making beet spirit,—introductory to a full and complete account of the best processes now in use in France, which we purpose to give hereafter.

It is well known that alcohol can only be produced by the fermentation of liquids containing sugar, and that hence, every vegetable containing that substance, whether in that form of it known as grape or fruit sugar, or as ordinary cane sugar, can be employed for the production of spirit. And a great variety of them have accordingly been tried; but independent of the first and best source of spirit, the juice of the grape, corn has hitherto been the chief source of spirit in Europe. This has arisen, not only from the superiority of the spirit, but also because grain forms the chief object of culture among nearly all people. The cultivation of that class of crops denominated "green crops" has only begun to become general within a century. None of the plants of that class could therefore have been proposed as a source of spirit prior to that period. But already, in 1770, spirit was manufactured to some extent from carrots in Saxony. The manufacture did not, however, extend, and, what is very curious, no attempt was made to substitute beet for the carrots for a long period after that plant had become a source of sugar.

The first person who seriously considered the advantages of using beet as a source of alcohol was M. Dubrunfant, who, in his *Treatise upon Distillation*, published in 1824, states, that about 15 gallons of spirits a little over proof, might be obtained from one ton of roots, rasped up and pressed, as in the manufacture of sugar, and that the juice contained a

substance capable of inducing fermentation, exactly like the yeast of beer. Nothing further appears to have been done relative to the subject until 1832, when MM. Lonvet Gilles and Jallu, of Péroune, took out a patent for the manufacture of spirit from beet-root, by means of the improved still of Derosne. This process consisted in washing and rasping the roots, and pressing the juice exactly in the same way that the roots are treated in the manufacture of sugar. The pulp, after having been pressed, was placed in a vat with an equal weight of water at 140° Fahr., allowed to macerate for about an hour, and subjected to a second pressing; the juices resulting from both operations were mixed together, and brought to a temperature of 90° Fahr., run into a fermenting vat, and about half a gallon of yeast added for every 44 gallons of juice. Fermentation immediately set in, and according as the alcohol was formed, the vegetable albumen, pectine, &c., which would interfere with the distillation, were precipitated, so that a regular clarification was effected. They also proposed to heat the beet by steam, and then press the resulting pulpy mass, and treat the juice in the way just described.

The next process proposed for the manufacture of beet-spirit was that patented by MM. Nicolle, Watringue Brongniart, and Monroy, of Arras, in 1838. According to this process, the juice obtained, as in the manufacture of sugar, was placed in vats at a temperature of 77° Fahr., and 3½ lbs. of sulphuric acid, 2½ lbs. of the pressed yeast of beer, and 4 lbs. 6½ oz. of a special preparation, intended to prevent the fermentation from becoming tumultuous, were added. This mixture consisted of 16 parts of coarse rye meal, 9 parts of wheaten bran, 1½ parts of fresh butter, 2½ of Marseilles soap, 1 of salt petre, and 20 of boiling water. The spirit obtained by this process was rectified with about half a gallon of vinegar, and about 1 pint of oil of vitriol, in order to give it a flavour by the production of acetic ether.

In the year 1844, M. Lalenne Delagrangé, of Valenciennes, patented a process for the same object, which consisted in exposing the roots to the action of steam, then breaking them up into a pulp, and allowing them to macerate with a little hot water and some chopped oat straw. The temperature of this mass being brought to 77° Fahr. by the addition of sufficient cold water, 10 parts of yeast were to be added for every ton of roots operated upon. In the same year also, M. Douay-Lesens obtained a patent for a process similar in many respects to the one just mentioned. The roots were steamed in close vats, the first condensed water being allowed to go waste until it was found free from smell and taste; in this way the peculiar essential oil of the beet, which renders the spirit obtained from the beet-root so disagreeable, was got rid of. The steamed roots beaten into a pulp were then fermented, one per cent. of malt being added, and from 10 to 14 pints of yeast for every 440 to 484 gallons of juice. The produce of alcohol was estimated to be about from 15½ to 18 gallons per ton of beet.

From 1844 to 1852, a number of other patents were granted for the manufacture of beet spirit, none of which present any new features, and we shall therefore pass them over, with the exception of a second

patent of M. Donay-Lesens, who proposed to boil the juice of the beet with sulphuric acid, in order to completely clarify it, and convert the cane sugar into grape sugar, and then ferment it with the addition of a little yeast and some linseed meal, to keep the fermentation from becoming tumultuous. He also proposed to make alcohol from the beet, sliced and dried, as it is prepared for the manufacture of sugar. For this purpose he washed the slices with hot water and a little sulphuric acid, instead of with lime, as in the manufacture of sugar, the subsequent treatment being the same as in the other cases.

Such was the condition of the manufacture at the end of 1852, when M. Dubrunfaut, whom we have already alluded to, as the man who first directed attention to the subject in 1824, took out a patent for improvements in the manufacture of beet-spirit, which he followed up by three others during the course of last year; the character of which we shall now discuss.

We have already seen that several persons had proposed to employ sulphuric acid in the fermentation of the beet-juice, for the purpose of precipitating certain substances, and the conversion of the crystallizable into uncrystallizable sugar, for which it had been long before used in the manufacture of spirit from beet molasses, by M. Mathieu de Dombasle. This acid, in certain proportions, as is well known, tends to check fermentation in beet juice, a property which it has in common with all the strong mineral or vegetable acids, at the same time that it converts the crystallizable sugar into uncrystallizable. But M. Dubrunfaut has found that if sulphuric acid be employed in very small doses, say of 1 per cent. of the sugar in the juice, it has the property of precipitating the natural fermenting principles of the beet, a substance which is then capable of re-acting upon the sugar, and giving birth to a perfect fermentation, without there being any necessity to have recourse to ordinary yeast. This, although but a further development of the fact, that the beet contains a natural ferment, first established by Dubrunfaut himself, as we have already stated, is one of the most important facts yet discovered relative to the manufacture of spirit from beet.

It appears from the researches upon which M. Dubrunfaut founds his patents, that the natural ferment of the beet has considerable analogy with that of beer, and that the quantity which is produced is three times more than is necessary to ferment the whole of the sugar contained in the beet. M. Dubrunfaut proposes to make the fermentation continuous; he first induces the fermentation to set in as rapidly as possible by the addition of a little yeast, that is, of about 2 or 3 gallons to every 10,000 gallons of juice. After the fermentation of each vat, the liquid is withdrawn, leaving a few inches in the bottom, in order to induce fermentation in a fresh charge, which is then introduced and allowed to ferment naturally; this in its turn is withdrawn, and a fresh charge again introduced, and so on, no further yeast being necessary than what was required to set the first vat in active fermentation. He proposes to utilize the excess of ferment rendered thus available, when the distillery is put in connection with a sugar factory, by employing it to ferment the beet molasses obtained in making sugar.

The second feature of importance in the patents of M. Dubrunfaut is, his proposal to macerate in the cold the sliced beet with a certain quantity of acid, corresponding to three per cent. of the sugar which they contain, by which the circumstances favourable to the fermentation of the sugar are changed, and the vegetable tissues forming the cells of beet are broken up. When this has taken place, the excess of acid is to be saturated with lime, so as to form the nearly insoluble sulphate of lime, which is precipitated to the bottom of the vessel. He also proposes to make spirit from roots sliced and dried, as was previously suggested by M. Donay-Lesens, but by the process of maceration with sulphuric acid. The third feature in these patents, is the proposal to separate all the salts of potash and soda contained in the residue of distillation of beet spirit. The beet is very rich in salts of potash and soda, and the more so in proportion to the size of the roots, and the stiffness or wetness of the soil upon which they are grown. When the juice is expressed from the roots nearly the whole of these salts are found dissolved in it. If the juice be employed for the manufacture of sugar, the whole of the soluble salts contained in it will be found in the molasses after the separation of all the crystallizable sugar. Among the uses to which this molasses has been put, is the manufacture of spirit; if a mixture of treacle and water be fermented and distilled, the whole of the salts will remain in the residue in the still, but the solution would be so dilute that they could not be economically recovered by the evaporation of the water. Some years ago, however, M. Dubrunfaut proposed an extremely ingenious process by which this object may be attained, and which has been very successful. The process consists in employing the residue from the still after distillation of the alcohol, and containing the whole of the soluble salts, for diluting another portion of the treacle to be similarly fermented and distilled. This process is repeated a number of times, until the saline matter increases to such a degree as to oppose an obstacle to the fermentation. When the concentration reaches this point the liquid is introduced into a thick iron boiler, where it is used for generating steam for heating the still, for the distillation of another portion of the liquid, until it becomes so saturated with salts, that it becomes unfit to rapidly generate steam; when this occurs it is run into leaden troughs, where the further concentration is effected, either by the waste heat of the flue, or by a separate fire. From the saline mass thus obtained, the various salts composing it are afterwards separated. The process proposed for obtaining the salts from the residual liquor, when spirit is made directly from the beet, is precisely the same in principle as that just described, and consists in using the residual liquors for effecting all macerations of roots, and for feeding the boilers.

We have now glanced at all the important patents connected with the manufacture of beet-spirit which have been obtained up to the present time, with one exception, which we shall discuss more fully presently, and we are now in a position to summarize the results arrived at through the supposed or real improvements, for which those patents were granted. These are:

1. That it is not necessary in the manufacture of beet-spirit to rasp and

express the juice by the tedious and expensive process by which it must be obtained for the manufacture of sugar, as the roots may be reduced to pulp either by the action of steam, or by maceration in the cold with sulphuric acid.

2. That beet-juice, obtained in the usual way, contains a substance analogous to yeast, and capable of converting sugar into alcohol, and that as the juice contains far more of this substance than is required for fermenting the quantity of sugar which it contains, no yeast need be used when the ordinary process of obtaining the juice is practised. And that even where the action of steam and of strong acids is had recourse to for the disintegration of the beet, an abundant supply of yeast may be obtained by rasping a small portion of the beet, and separating the juice by maceration, which will then yield the ferment by the addition of small portions of sulphuric acid.

3. That beet sliced and dried, and which may be preserved like grain for the entire year, can be employed to make spirit.

4. And that the salts contained in the juice may be profitably extracted from the residual liquor after distillation, when large quantities are operated upon.

All the processes which we have described are adapted, and indeed require to be conducted upon a large scale; but there is one which may be carried on upon so small a scale, and the nature of which is so simple, that a distillery employing it may be attached to an ordinary sized farm. This is the process of Champonois, to which we directed attention in the first number of this Journal, and that we are now in a position to describe more in detail.

It depends upon two happy ideas, namely: 1, to extract the juice from the beet cut into thin slices, by displacement, and by endosmosis, by means of the residual liquors from the still, which restores to the slices all the substances, more or less modified, taken from them by the maceration, with the exception of the sugar converted into alcohol. And 2, to assure the regularity of the fermentation without a continual consumption of yeast, by making a great quantity of yeast produced from the beet juice itself to act in a continuous manner upon small quantities of the saccharine juice, flowing in a fine stream into the vats during several hours. The process has been carried out during the past season at the farm of the Messrs. Huot, near Troyes, and has been made the subject of a report, by a commission appointed by the French society of agriculture, composed of Messrs. Boussingault, Payen, and Pommier, the reporter being M. Payen. As this report goes into sufficient detail of the method of conducting the process, we shall present our readers with the substance of it, so as to enable them to judge of its value.*

The roots employed at the farm, when the commission visited it, were the common white and red mangels, but so altered that many of the roots were in a state of putrefaction. Three women were employed in cutting

* Rapport à la Société Impériale et Centrale d'Agriculture.—*Annales de l'Agriculture Française*, T. III. No. 8, p. 356

away with a knife the decomposed parts of the roots and washing them, the quantity required for each day's work being 2,250 kilogrammes (2 tons 4 cwts. 1 qr. and 4 lbs.). The washed roots were then cut into slices about the one-fifth of an inch wide, and the one-eighth of an inch thick, and of variable length. Two men are able to work the machine for cutting 250 kilogrammes (or nearly 5 cwts.) of roots into such slices in 25 minutes. This operation is repeated every hour, so that in the course of nine hours, the whole of the roots required for the day's operation are cut up; the 5 cwts. of roots cut in each operation make the charge for a vat of a capacity of 550 litres, or 121 gallons. There are three such vats, each of which receives in its turn an equal charge of sliced roots; into the first vat when charged is introduced 200 kilogrammes, or close to 4 cwt., of the boiling hot residual wash, which remains in the still after the extraction of the alcohol; this displaces the juice in the sliced beet, which being heavier, descends towards the bottom of the vat, while the wash takes its place in the sliced root. After the lapse of an hour, a second charge of roots having been cut, is introduced into a second vat; a second charge of about 4 cwts. of boiling wash, is then run into No. 1 vat, which displacing the liquid in it, causes the denser portion or juice to pass by a pipe from beneath a pierced false bottom, upon which the sliced roots are placed, into the top of No. 2 vat. There, being denser than the juice in the fresh cuttings, it removes a portion of the sugar contained in them, and becomes still more highly charged with saccharine matter. A third charge of boiling wash is now introduced into No. 1 vat, which displaces the liquid of No. 1 charge, now loaded with sugar, and sends it into No. 2 vat, where it displaces the rich juice, and sends it from the bottom of No. 2 into the top of No. 3, where it becomes still more highly charged with sugar, and from whence it passes into the fermenting vat. The sliced root in No. 1 vat is now considered to be sufficiently exhausted, and the excess of water is accordingly allowed to drain out into a proper vessel, from whence it is taken to be re-heated, in order to serve for the same purpose again; the exhausted slices are now removed from the vat by means of forks, and carried at once to the farm yard, where they are mixed with three times their bulk of chopped hay, straw, &c., in a large vat of from 247 to 282 cubic feet capacity, which is capable of containing all that is produced in one day. The vat No. 1, thus emptied, is re-filled with fresh beet, and then becomes No. 3 of the series, No. 2 becoming No. 1, and receiving the charges of boiling wash as before. There is thus about 55 gallons of saccharine juice sent to the fermenting vats, and from 4 cwts. to nearly $4\frac{1}{2}$ cwts. of exhausted slices sent to the farm yard every hour.

The fermentation is effected in the following manner: There are four fermenting vats, each of a capacity of about 550 gallons, and consequently capable of containing all the juice produced in one day. To the first charge of juice, which passes into No. 1 of these vats, is added about 9lbs. of yeast, and the fermentation is allowed to go on during 24 hours, in the first 12 hours of which the vats get filled with juice. Half the contents of this vat is then transferred into another empty one, each of

which will be thus half filled: the operations of the previous day then recommence; the juice produced by each maceration is introduced in equal portions into these vats. The liquid, which is then introduced in small quantities, ferments according as it arrives in the vat, and a regular ebullition is produced by the continuous evolution of carbonic acid. In the evening the two vats become filled. On the following morning half the contents of one is transferred into an empty vat as before, while the other is allowed to cool down during 24 hours, that is, until next morning, and in the mean time the two half filled vats become filled. We have now three full vats, No. 1 of which is ready for distillation, which is accordingly commenced. No. 2 is allowed to cool down until the following morning, in preparation for the same operation; and half the third is transferred into a fourth empty one, both of which become filled during this day, whilst No. 1 is emptied out during the same time, and thus becomes available for continuing operations on the following morning. The four fermenting vats are therefore in constant operation, one of which is worked off in the still every day. Another is in the process of cooling, and two in process of filling; each vat requiring 48 hours to get filled, fermented, and cooled down. The operations are entirely confined to the day time, and in the evening all the empty vessels are carefully cleaned. In the bottom of each vat is found about seven to eight gallons of dregs or yeast, which is put into the second boiler of the peculiar still employed (*Derosne's*), in order not to derange the apparatus. This mass is very rich in nitrogenous substances, and when the residual wash is run upon the sliced roots, these substances are filtered out of the liquid by passing through the layer of cut roots.

The spirit obtained is not rectified, but is sold in its raw state, and used either directly or for rectification, or is made into vinegar: the daily produce is estimated at 180 litres, or 39.6 gallons of spirit, a few degrees over proof, or about 17.8 gallons per ton of roots.

The exhausted slices which have absorbed the residual wash, and which, as we described, were mixed with chopped straw, &c., and placed in a large vat, are allowed to ferment during four or five days, in order to render the mixture more assimilable and advantageous in the feeding of cattle. M. Champonois considers that these slices have only lost their sugar, and that in other respects their nutritious value is not diminished, except to that amount. At Messrs. Iluots' farm this mixed mass is employed to feed 50 head of cattle, that is to say, cows, oxen, bulls, &c., who receive, per head per diem, the equivalent of from 57lbs. to 66lbs. of slices and 22lbs. of hay or straw. The surplus amounting to about 14cwts. to 15cwts., of slices mixed in the same way with three times its bulk of chopped hay or straw, is employed for feeding 150 sheep. All the animals were in excellent condition, the cows give more milk than with the food in previous use on the farm. It has also been remarked that the butter is sensibly more consistent, and less highly coloured. The cattle are fed with this kind of food once in the morning and once in the evening; in the middle of the day each gets some straw; and they are described as eating the mixture of sliced roots and chopped straw or hay, left to ferment for some days, with great avidity.

Although M. Champonois thinks, as we have just remarked, that the slices thus impregnated with the residual wash, are nearly equal in nutritive value to the original root, there are many reasons for thinking otherwise. The true nature of nutrition is as yet but imperfectly understood, and mere chemical explanations, in the sense in which that term is now understood, do not account for all the phenomena; assuming that to be the case, however, there can be no doubt of this, that there is no use of supplying an animal with such an excess of any one ingredient of its food, that under no conditions could it assimilate it. Or in other words, that there must be a certain relation between the constituents of an article of food, and any excess of any one of them will be useless, if not injurious. Now if a distillation of beet-juice be well conducted, the residual wash will contain almost nothing dissolved but the soluble salts, the greater part of the nitrogenous constituents being nearly in a state of suspension. In saturating the sliced root with this liquor, we are simply saturating them with a saline solution; but a simple calculation will show that such saline substances are not necessary to such an extent for animals, and that the efforts of agriculturists ought rather to be directed to diminish than to increase the quantity of saline substances in plants. The quantity of soluble salts in one day's food of beet is fully equal to the quantity which a cow would require to assimilate in two days, and if the roots be large, the excess may be doubled or trebled. It is therefore questionable whether, allowing the residual wash to settle, in order to collect the rich nitrogenous substances, and pouring off the saline liquor, and employing only pure water for the maceration, would not yield as good a food for cattle as that proposed by M. Champonois's process above described. By the latter process the fuel required for heating the liquor for maceration would be economized, as the wash would be run directly from the still upon the sliced roots, whilst where water would be employed, although this economy would not be effected, the macerated slices would not have so loosening an action upon the cattle, owing to the removal of the large excess of salts.

Another objection may be made to the process of a purely economical character, namely, how far is it advisable to join manufacturing operations of a complicated kind with the business of agriculture? Experience derived from other branches of industry are certainly not favourable to such a junction. It is not, however, our intention at present to discuss any of these objections, our object now being simply to direct public attention to the importance of the subject for this country, and to guide those, of whom there are many in Ireland, who have at various times attempted the manufacture of beet-spirit, by teaching them what has been done in France, where the problem has been, in our opinion, completely solved. In a future number we shall return to this subject again, with the object of providing our readers with a short treatise upon the most approved system of manufacture, and the economical conditions under which it may be successfully carried out.

ART. II.—Method of rapidly bleaching Wax, and purifying Tallow, Oils, &c.

WAX, properly speaking, consists of pure wax and a colouring matter; there are several kinds of wax, distinguished commercially by the relative amount of colouring matter which they contain. Formerly it was supposed that wax could only be bleached by the action of sunlight; to effect this object the operations could only be commenced in the month of May, when the fine season has set in, and the sun attained sufficient altitude to send its rays more directly for a longer period and with more force; and these conditions continue only at most for three or four months. To bleach wax by this process, it must be made into ribands of great tenuity, or feathered as zinc is by being poured into water; an operation which must be repeated at least three times, whilst the duration of the exposure to the sunlight must occupy from one month to six weeks, in order to destroy the colouring matter to which we have alluded. To do this requires a considerable space, which is often very expensive, and a heavy outlay in plant, such as bleaching frames, canvass, &c.; this primitive condition of the wax industry renders the bleaching not only embarrassing, but uncertain and variable according to the weather.

In order to diminish the amount of capital which was required to be sunk in this branch of trade, and, above all, to shorten the time required to bleach the wax, M. Cassgrand, some years ago, patented a process in France, which has now passed into the public domain, and which, it appears, has been very successful.

This process consists in melting the wax by means of steam, until it becomes very liquid, and then passing it, along with the steam, through a kind of serpentine or worm, by which a large surface becomes exposed to the action of the steam. After traversing the worm it is received in a pan with a double bottom heated by steam, where water is added in order to wash it; from this it is elevated by a pump, kept hot by steam, into another pan similarly heated, and where it is also treated with water, and is again passed through the serpentine. This operation is repeated twice, thrice, or four times, according to the quality of the wax; during the passage with the steam through the worm, it becomes denser by, it is said, absorbing water (perhaps mechanically?), and deposits in the upper pan. It is allowed to repose in this for about four or five minutes after each passage; and after the last one, about one or two hours, according to quantity, in order to allow of any impurities to subside. The wax is then granulated in the ordinary way by means of cold water, is allowed to dry during two or three days, and the action of light and air does the rest, for which one person is sufficient. The whole of the operations do not require more than a few days, are perfectly certain, and are attended with no danger. Independent of the advantage which such an apparatus has for bleaching wax, it has also that of enabling its qualities, according to relative whiteness, to be distinguished; for this purpose it is only necessary to present the wax in mass to the end of the worm, and in a second or two the vapour determines the relative colour which it will yield.

This process is also applicable to the purification of tallows and of oils; even fish oil, when passed through the apparatus of M. Cassgrand, and washed as just described, is completely deprived of its disagreeable smell; and if it be set aside in a place where the temperature only reaches from 59° to 68° Fahr., a fresh deposit will form, and the oil will become perfectly clarified and nearly colourless.

This process has considerable analogy with one which Mr. Dixon, of this city, patented some time since for bleaching palm oil; the principle of which was exposing the oil to the action of steam. Cassgrand's apparatus might, no doubt, be applied to the same purpose, and appears to us to have certain advantages over that of Dixon, especially in exposing a larger surface to the action of the steam, and varying that surface oftener. If not already known here, the process is worthy of the serious attention of soap-boilers. Such a method would evidently be much more effective than the present system of purifying oils, especially where sulphuric acid is used, which is almost universally the case. As that acid is scarcely ever effectively removed, many samples of trotter, rape, and other similar oils, are usually quite acid; where the former is used for the manufacture of hair oil, it is very destructive to the hair, and the latter destroys the lamps when used for burning, &c. The only modification required for the purification of oil would be to divide the oil as much as possible by means of a diaphragm of copper, pierced with holes, in the first steam vessel, and thus expose the largest possible surface to the action of the steam in flowing through the pierced diaphragm into the worm.—See *Le Génie Industriel*, No. 38, vol. vii., p. 72.

ART. III.—On the uses to which Turf might be applied in Ireland. No. 2.

PEAT CHARCOAL.

In our last number we directed attention to a new and novel application of peat to the manufacture of paper, papier maché, and *carton pierre*, and we now purpose to make some observations upon another of its applications, the value of which is already fully appreciated by the public, although but seldom taken advantage of; namely, the manufacture of peat charcoal for deodorizing purposes.

From some remarks which we have seen lately in the newspapers, it would appear that an impression prevails that this application of peat charcoal is protected by patent. This we doubt, because already, many years ago, the distinguished Irish chemist Richard Kirwan suggested this use of peat mould and semi-charred peat for absorbing fetid liquids; and peat charcoal has been employed to some extent for such purposes in Paris for a period of more than twenty years. A patent has been obtained for a peculiar process of preparing it, and probably this led to the notion that no one could make it, for the special purpose of using it as a deodorizer, but the patentee. The manufacture of peat charcoal is therefore open to any-

body who is willing to embark in it; and the greater the number is who do so, the greater will be the probability of success, for the demand would be almost unlimited, if the supply were regular, and the article could be sold at a reasonable price.

Porous bodies, and especially charcoal, have the property of absorbing gases, in certain proportions depending upon the nature of the porous substance and of the gas. For example, wood charcoal, when freshly prepared, will absorb 90 times its own bulk of ammonia, but only $1\frac{1}{2}$ times its bulk of hydrogen. In the same way porous bodies absorb liquids, a familiar example of which is offered in the common sponge. Freshly prepared peat charcoal is capable of absorbing from 120 to 170 per cent. of its bulk of water, and yet form a more or less solid mass, from which water will not drain; consequently, one ton of charcoal will take up nearly two tons of fetid water, and form only a pasty mass. No matter how putrescent the water may be previous to being mixed with the charcoal, all smell will disappear. If more fetid water be poured upon the pasty mass of water and charcoal, the latter not being able to absorb it, the water will filter through, but in its passage will be fully deprived of all disagreeable odour. A bed of peat charcoal will therefore act as a filter for purifying sewerage water, and will completely prevent the escape of unwholesome and stinking effluvia. The action of peat charcoal is not confined to gases and liquids; even solid putrescent matter, if mixed with it, is almost instantaneously deprived of smell.

The quantity of charcoal which is sufficient to produce any of the effects just mentioned is comparatively small, so small indeed that no difficulty can arise as to its use upon this account.

In most cities and towns the provisions made to get rid of the excrementitious matter, the sewerage water, the waste from factories, &c., is most defective, and especially in those parts where business is most active, and space consequently more valuable. In many of those places the soil is impregnated with decaying organic matter, or the house is surrounded by or covers one or more cess-pools, which are constantly generating noxious gases and effluvia, which, by their combined action upon the body, lower its vitality, and render the inhabitants extremely liable to catch epidemic and contagious diseases. It is impossible to conceive any thing more disgusting, for example, than the provisions made in some houses for privies and water-closets, most of which, when they exist at all, are mere receptacles for filth, without exit, except by soaking into the surrounding soil, and reeking with pestilential exhalations, while they are being filled up in the course of years. In such places the general use of peat charcoal would be attended with the greatest benefit to the public health. And even where the most perfect system of sewerage may exist, its use would be equally valuable, by preventing the polluted drainage liquid of a city being poured into the rivers.

Who that has visited an hospital, no matter how well kept, that is not sensible that much more might be done to render the air pure and free from disagreeable odours, and thus conducive to the health of the inmates. We are fully convinced that fresh air, light, and cleanliness, are quite as

useful remedies in all diseases as the most powerful medicines; but unfortunately they are not so generally prescribed as they should be. Among the many ways by which hospitals may be kept in a proper condition, the extensive use of peat charcoal would be perhaps the most effective. It is needless to point out any further applications, as they are already well known to our readers, or will suggest themselves to every one, bearing in mind the deodorizing properties of the substance. The uses to which we have alluded will, however, bear out our statement, that the demand for it, if the supply were regular and at a moderate cost, would be unlimited. Before, however, coming to the object of this paper, which is the mode of meeting that demand, or, more properly speaking, of creating it, we must allude to another proposed application of peat charcoal, for the purpose of correcting some opinions held with regard to it, and which we deem erroneous; namely, the employment of peat charcoal as a manure.

Without denying that peat charcoal may have some action as a manure, we are convinced that its value in that respect has been greatly exaggerated. A substance can only act as a manure in two ways—mechanically or chemically. To act in the former capacity very large quantities must be employed. If some twenty or thirty tons of peat charcoal were mixed with the superficial layer of soil of an acre of land, it might perhaps produce a perceptible influence upon the physical properties of the soil; but any one who has ever seen two tons of charcoal sprinkled upon the same area, will at once admit that such a quantity could produce no perceptible influence upon the physical character of the soil. The chemical influence of a manure is judged by the absolute amount of certain constituents which it contains, and also by the peculiar condition or state of combination in which they exist. Our information as to the relative value of each ingredient is no doubt very defective, and on this account no absolute judgment can be pronounced upon the absolute manuring value of any substance. Certain general principles have, however, been established, and these enable us to ascertain approximately the relative manuring value of a substance, or at least sufficiently so to be of great practical use.

The first element in the value of a manure, whether considered in its mechanical or chemical character, is its cost. This is quite intelligible; for a manure may be very valuable at 5*s.* per ton, and worthless if it could not be sold for less than £1 per ton. Now this is exactly the case with peat charcoal; it contains in its ash many valuable constituents, but the price at which it has hitherto been sold is more than double what the same substances could be purchased for in other forms. When peat charcoal is mixed with night-soil, or other similar substances, in the proportion of two of charcoal and one of night-soil or even of equal parts, the value of the mixture, estimated on the same principles as are usually applied in the case of guano, would not be more than 15*s.*, or at the utmost, £1 per ton. At least we have seen no samples, the analyses of which would warrant the assumption of a higher value.

Hitherto the prices charged for peat charcoal have been such, that the sum realized by the manure produced, if estimated at its true value, would not be sufficient to cover the original outlay for the charcoal. For

example, if one ton of charcoal cost £2, and that it be used for deodorizing an equal quantity of night-soil, the resulting manure might be worth £1 per ton, and would therefore realise £2, the original outlay for the charcoal. This would be an exceptional case, however, for in the majority of cases where the use of charcoal would be beneficial as a sanitary agent, the substance which the charcoal would absorb or be mixed up with would be merely sewerage water, urine, &c., which contain but little solid matter, and would not add much to the real value of the charcoal as manure—one ton of which would perhaps not be worth more than 6s. or 7s.

If peat charcoal be used for domestic purposes by the wealthier classes, the value of the resulting manure is a matter of comparative unimportance, not alone from the small quantity produced and other circumstances of a social character, but because people who can afford it are at all times ready to pay for anything that conduces to their comfort. Peat charcoal would therefore be employed by such persons, irrespective of any ultimate benefit to be derived from the manure. But it would be quite different if it comes to be used by the poorer classes, in hospitals, &c., and it is in this direction that its use would be attended with most public benefit: the manure produced should yield a premium upon the price of the charcoal. This clearly could only be done by producing the charcoal at such a price that the manure produced by its use as a deodorizer would be worth more than the price of the charcoal. Although, as we have remarked above, the production of manure would exert no influence upon the use of small quantities of peat charcoal for domestic purposes, in the houses of the wealthier classes of cities, the lowering of its price would, as in the case of every other commodity, tend to increase the demand. In order, therefore, to extend its use amongst all classes, and to obtain the largest amount of public good from its employment, the great object to be attained is to produce the charcoal at a cheap rate.

The question of how this is to be done presents itself under two points of view: the cheapest mode of raising raw turf, and the cheapest and most effective process of charring it.

With regard to the first point much may be said, and it is perhaps one of the most important subjects which could be discussed; but as we will return to it again on the earliest opportunity, we may therefore pass it over on the present occasion, and assume the cost of raising turf upon the experience of the large operations which have been conducted within the last few years in Ireland.

A few years ago Mr. Jasper W. Rogers got up a company for the manufacture of peat charcoal, under the name of the Irish Amelioration Society, and a station was established at Robertstown, in the county of Kildare, on the edge of a bog of about 15 miles in extent, and verging in thickness from 15 to 20 and even 30 feet.

The factory was so placed that it was below the level of the part of the bog where the turf was dried, and afforded considerable facilities in consequence for the transport of the turf to the factory by means of a tramway. The first operation, preliminary to cutting the turf, was to drain the bog. This was effected by cutting a large trench in the direction of the

axis of the bog, and sunk about 3 or 4 feet into the subsequent deposit of marl and gravel. A number of drains cut at right angles to the main trench carried off the water of the lateral parts of the bog. The main drain or trench discharged itself into a small rivulet. The drainage rendered the turf more compact, and gave it a firm consistence, which allowed of its being easily worked. The cutting of the turf was effected by making a series of platforms of considerable length on each side of the principal trench, and parallel with its direction; the bricks, as fast as cut, were carried away on wheel-barrows and laid out to dry; the subsequent management being the same as is usually practised.

Although this system was on the whole not very economical, owing to the great amount of wheeling required, the turf could be brought to the factory, after an air drying of about one month, for 2*s.* per ton. At the works of the Irish Peat Company, near Athy, where there is no organized system of turf cutting yet established, but where, nevertheless, a good economy of labour is observed, the average cost of producing one ton of well dried turf, inclusive of rent of bog, cost of cutting canals and making drains, would be about 2*s.*, supposing 40,000 to 50,000 tons to be annually cut; the very dense peat would of course cost much less, say 1*s.* 4*d.*, and the very light flow peat about 2*s.* to 2*s.* 6*d.* This sum corresponds pretty nearly to the cost in Bavaria, where turf is abundant and used for a great variety of purposes. The turf is there artificially dried; and one ton of the light fibrous is usually considered to cost 2*s.* 5*d.*, and the dense black turf 1*s.* 3*d.* to 1*s.* 4*d.*, the mean of both being under 2*s.* It is proper to remark, however, that the artificially dried turf is superior to our air dried. The men earn at turf cutting in Bavaria about 1*s.* a day, and the women and children 4½*d.* to 5½*d.*; that is practically the same wages as are earned at Athy, but one-fifth more than was paid by the Ameliorating Society!

By the careful distillation of good air dried turf from 30 to 40 per cent. of charcoal may be obtained, but in practice more than 25 per cent. need not be calculated upon by the methods at present in use; at Robertstown, from 23 to 25 per cent. was the quantity obtained. Assuming it then at 25 per cent., or one-fourth, four tons of peat would be required to produce one ton of charcoal; this at 2*s.* per ton for the turf would give 8*s.* as the cost of the raw material. The next question to be considered is, what is the cost of charring?

A great many methods have been proposed to char peat, and the question of the cost of charring entirely depends upon which method is selected. We shall accordingly describe briefly the chief of these methods.

Mr. J. W. Rogers's plan consisted of a sort of grating placed upon a kind of tramway a few inches below the general level of the floor of a building, consisting of three sheds, formed of roofs supported upon pillars, and open in great measure at the sides, provision being left in the roof for the escape of vapours and smoke. Over each grating was placed a truncated square pyramidal sheet iron case, the top or truncated portion being capable of being covered. A little lighted turf or charcoal was introduced into this case, which was then charged with turf; as soon as the turf was fully

kindled, the cover was put loosely upon the top, and the carbonization went slowly on, assisted by a small quantity of air, which got in under the edge of the bottom, and burned the gases. After a certain time the mass sunk down; the void was then filled up with fresh turf, this operation being performed two or three successive times. After the last charge had been introduced, and the whole of the vapour and the greater part of the gases had been consumed, the lid was fastened on and luted, a small exit pipe being left for the gases; and so soon as the latter had ceased to be produced, the pipe was closed, and by means of a cock water was allowed to flow around the base to the depth of a few inches, so as to effectually prevent the air from entering the charring oven under the lower edges of the case, and allow it to cool down. The whole operation lasted five hours, of which three were devoted to the carbonization and two to the cooling; so that, including the time necessary to charge and discharge, four operations could be made in twenty-four hours. The charge of each moveable sheet iron furnace consisted of from 600 lbs. to 700 lbs. of turf, and produced from 23 to 25 per cent. of charcoal, or 138 to 181 lbs. every operation, or a mean of about 600 lbs. in twenty-four hours; so that it would take four such furnaces to produce one ton of charcoal in twenty-four hours. This system, although ingeniously contrived, was exceedingly expensive, there being a large outlay in plant, a great deal of labour required to feed and manage the furnaces, and above all, the wear and tear, as may be readily understood, was exceedingly great. Considering that the small quantity of charcoal produced had to bear all these expenses, it is very difficult to estimate the expense of producing one ton of charcoal. But we have heard it variously estimated at from £1 5s. to £1 10s. Such a process does not therefore fulfil the conditions which we have laid down above.

At Crouy-Sur-Ourcq, near Meaux, where large quantities of peat are prepared for the Paris market, a very good kind of furnace is used. It consists of a cylindrical retort, built of brickwork, of about 250 cubic feet capacity, and therefore capable of holding somewhat more than four tons of average peat, this cylinder is surrounded by a jacket of brickwork, open spaces filled with air being left between the masonry of the cylinder and the jacket, for the purpose of maintaining as uniform a temperature as possible. It is heated by two small fireplaces, the flame and hot air from which circulates round the *shirt* or internal masonry, the smoke escaping through an opening in an iron plate on the top. The top of the retort is also closed with a tight fitting lid, which is luted when the retort is charged; over this lid is then placed the iron plate just referred to, through which the smoke escapes, so that the latter is made to pass over the lid of the retort and heat it. The bottom of the retort is closed by a damper, which can be withdrawn when the charge is coked, so as to allow the charcoal to fall into a pit underneath, where it is kept covered up until it is sufficiently cooled to be withdrawn without risking its taking fire, which warm freshly prepared peat charcoal is very liable to do. A pipe issues from near the top, which conveys away the products of distillation; by slight refrigeration the ammoniacal liquor and tar is condensed, whilst the gas is conveyed

under the retort, and by its combustion diminishes very considerably the amount of fuel required to heat the retort. This system of retort is therefore continuous and economical, and yields besides a considerable quantity of tar, which may be employed in making gas. Turf of medium quality costs, at Crouy-sur-Ourcq, about 5*s.* 2*d.*, and dense black peat even as much as 7*s.* per ton; but when worked on a large scale the cost may be as low as 4*s.* The charcoal being made in a close retort, none of it is burned as a fuel to assist in the carbonization of fresh turf, as in Mr. Rogers's process, and hence, three tons of good dry peat will yield fully one ton of charcoal. The cost of raw material would thus be from 12*s.* to 15*s.* 6*d.*, and for the finest compact peat, used for making very dense charcoal, even as high as 21*s.*; although a larger product is usually obtained from the latter, which goes a certain way to compensate for the increased cost of the peat. The cost of carbonization may be set down at about 3*s.* to 4*s.*, against which we have to set off 1 cwt. 3 qrs. of tar, the precise value of which we cannot estimate, but it may be set down merely as a fuel at 1*s.* per cwt., or 1*s.* 9*d.* for the produce of three tons of turf. Charcoal would therefore cost at Crouy, by the lowest estimate, 14*s.*, or, calculating by the average price of fuel there, 17*s.* 6*d.* per ton. This is much below the cost at Robertstown, notwithstanding the difference of cost of the peat.

In East Friesland an excellent kind of carbonizing furnace is used, by which the volatile products may also be saved. A solid base is first built, 16 feet long, 13 feet wide, and two feet high; upon this is then erected an oblong furnace, 12 feet long, 5 feet wide, and 8½ feet high, the end walls being 2 feet thick, and the side walls 6 inches. Parallel with these thin walls, and of the same length and height, and at a distance of 1½ feet from them, are built two walls, 2 feet thick. The end walls are continued to meet these thick walls, so as to completely enclose the narrow space between the thick and thin walls; these enclosed spaces form fire channels, and each has at one end a fire place, 1 foot wide and 18 inches high, with a grate and an ash pit, opening 1 foot square, and at the other a chimney. The chamber enclosed between these fire channels constitutes the retort, and has a charging door, 5 feet high and 3 feet wide, at the same end as the fireplaces. The retort is arched over, and from the exterior thick walls or jacket, as we may call them, other arches are sprung, which meet on the top of the retort arch, so as to enclose the fire channels and cover as much of the inner arch as possible, so that the greater part of it may be heated by forming part of the walls of the flues. The floor of the retort is covered with fire tiles, and is hollowed along its whole length towards its centre, to the extent of 6 inches, and along this central hollow runs a glazed clay gutter, covered with perforated tiles, and having a slight inclination towards one end. The condensed water and tar run along this gutter, and are carried by a pipe from the farther end to a vessel placed in the ground, in a small building about 20 feet from the furnace, the gas being conducted back by another pipe to be consumed in the furnace. Several of these furnaces are usually built in a row, by which, of course, there is great economy of materials and of fuel. One furnace of this kind is capable of producing about one ton of charcoal from good compact peat

at each operation. The cost of carbonization is of course very materially influenced by their being one or several worked, but we have heard it estimated at from 4s. to 5s. per ton.

The last form of furnace which we shall notice is one used in Bohemia, and, like Mr. Rogers's plan, is not heated by a separate fire, the carbonizing heat being produced by part of the turf itself, and is maintained by the combustible products of the distillation of the rest. An excavation 6 feet deep is first made, and in this is built a circular foundation, 9 inches deep, and 20 feet in diameter. Upon this foundation the kiln is built; the walls at the base are 5 feet, tapering on the outside to 2 feet at the top, the total height being 16 feet, the internal diameter is therefore 10 feet. Where possible, it ought to be built like a lime kiln, against an incline, so that the top may be on a level with the ground on one side, and the base exposed on the other, where the charcoal may be discharged with facility. Where this cannot be done, 6 feet of it ought, at least, to be built into the ground. The kiln is domed at top; the arch being two feet high, a conical aperture is made in the dome, three feet in diameter externally, and two feet internally, which is capable of being closed with a door fitting into a ring of iron built into the dome; this aperture serves for introducing the peat. The discharging aperture, near the bottom of the furnace, is four feet and a half high, and two and a half feet wide; this is not closed with a door, being usually built up with bricks when the furnace is charged, but the arched passage which leads to it, and which is made six feet high and five feet wide, may be closed with boards to keep in the heat.

The hearth or floor of the furnace has a circular canal ten feet in external diameter, that is all around the inner circumference of its wall, nine inches wide and fifteen inches deep, which is intersected by two cross canals of the same dimensions, one of these terminates under the discharging door. These canals are filled with brushwood previous to charging the furnace, and are partially covered over with loose tiles, eighteen inches wide and eighteen inches long, the intervals between the tiles being nine inches. In charging the furnace a long pole is placed perpendicularly in the centre, where the cross drains intersect one another; similar poles are also placed at the extremities of the cross drains, where they intersect the circular drains. The turf is piled up in layers, each brick being placed on end. When the furnace is full the sticks are withdrawn, the centre one through the charging hole, and the others through four holes left in the arched roof, which may afterwards be closed when required by a brick and some clay, or with a cast-iron cover. The withdrawal of the poles leaves five vertical flues communicating with the horizontal ones. These flues are necessary, because from the regular form of the bricks of turf, they would pack so close that the draught of air would pass with great difficulty through. The brushwood in the part of the horizontal flue under the discharging door is ignited as soon as the furnace is charged; the air causes the fire to extend throughout the whole of the horizontal canals, a draught being established up the vertical flues. In this way the whole of the mass of turf is ignited equally. The orifice under the discharging door, the charging hole, and the orifices of the four

flues around the circumference of the furnace, are kept open until flame freely issues from the five vertical flues, when the quenching must be attended to. To effect this the door of the charging hole is luted on, and the conical hole over it, corresponding to the thickness of the brick-work, filled up with clean sand, the orifice of the horizontal flue, or the "firing hole," is then closed with an iron door, and the orifices of the vertical flues loosely covered, room only being left for the escape of the products of distillation; and when these cease to be generated the latter are plugged up and luted, and the furnace allowed to cool during forty-eight hours.

In some furnaces of this kind the four vertical flues around the wall of the furnace are often made without the aid of poles, being constructed as the charge is filled in; this is, however, a tedious and troublesome plan, and the other ought, therefore, to be preferred as the simplest and most economical.

This furnace has been very successful both in the quality of the charcoal and the economy of production; the charcoal is very largely employed in many branches of the iron manufacture, for which it is much better adapted than that charred on the principle of the furnace at Crouy-sur-Ourcq. The cost of charring by this furnace is stated not to exceed, with good dry medium quality turf, 4s. per ton of charcoal.

Turf is also charred in *meilers* or heaps, as wood charcoal is usually prepared, although from the great contraction which turf undergoes when carbonized, difficulties are experienced which do not occur in the case of wood. These difficulties are not, however, insurmountable, as is proved by the fact that a good deal is prepared in that way in the Vosges, in Bavaria, and in Saxony and Bohemia. Two forms of meilers are made; the circular or bee-hive form, so commonly used for wood, and the rick-shaped.

At the Royal Iron Works of Weierhammer, in Bavaria, where, since 1838, the refining and puddling furnaces, &c., have been exclusively worked with turf, the bee-hive form of heap is the one adopted. A base or level spot is first formed, in the centre of which is fixed a pole; upon the base or hearth is then spread a quantity of broken sticks or brushwood, and upon these some charcoal waste from a previous operation; the turf is then piled round the stake, so as to form a heap somewhat like a bee-hive in shape. The usual size of the meiler is about 2,520 cubic feet, or nearly $13\frac{1}{2}$ tons of the peat of that district. The heap is ignited by putting some brushwood at the bottom of the vertical flue left on withdrawing the stake about which the heap was formed. The heap is covered with sand and turf ashes, the top, however, being left uncovered until the meiler is fully ignited; the subsequent management of the heap is exactly the same as in the charring of wood, except that the turf meiler must be ignited stronger than a wood one before covering up completely, and the carbonization must be conducted to a greater degree before being perfectly choked. Great care must also be given to keep the heap properly covered during the great sinking down which occurs.

In twelve to fourteen days a heap, of the size indicated, is cooled

enough to be removed, and in doing so care must be taken not to break up the charcoal too much. If the charring has been carefully conducted, 2,520 cubic feet of turf give, at Weierhammer, 700 cubic feet of charcoal, or about 27·7 per cent. in bulk of the peat. This charcoal has very nearly the same density as the peat, one cubic foot weighing about 11lbs., so that $13\frac{1}{2}$ tons of peat would give about 3 tons 8 cwt. of charcoal, or in other words, 4 tons of peat would be required to produce 1 ton of charcoal, the average weight of charcoal obtained being $25\frac{1}{2}$ per cent. or somewhat less than 4 tons of peat to one of charcoal.

The turf used at Weierhammer costs on an average, 2s. 11½d. per ton, and the estimated cost of a ton of charcoal on the spot, is 16s. 1¾d., which, assuming 4 tons to be required to make one of charcoal, gives as the cost of carbonizing, 4s. 3¾d. In the neighbourhood of the *Carolinen Hütte*, near Achthal in Styria, where some successful attempts have been made to smelt iron with turf, in its raw state, mixed with wood charcoal; and where peat charcoal is used in some of the iron works for forging, &c., charcoal made on the same system, cost 22s. 6d. per ton, the turf costing 18s. 2d. of that sum, or 4s. 6½d. per ton. This leaves 4s. 4d. for the expenses of carbonization, or practically the same sum as at Weierhammer.

In Saxony, a good kind of rick meiler is made, which has given very successful results. The ground is levelled and covered with sand, and upon this a rectangular space is marked out, 50 feet long, and 5 to 6 wide. The centre of this space is hollowed out into a sort of basin, and two fire channels or drains are made along its length, one from each end of the space to the basin, towards which they are made to incline. The basin and fire channels are formed of bricks, the interstices being filled with clay, in order to prevent the liquid products of the carbonization from sinking into the earth. A small gutter passes from the central basin for the conveyance of the condensed liquids to a reservoir. The base being thus arranged, a number of stakes are placed upright along the line of the fire channel, at intervals of 10 feet, the meiler is then built to the height of about 4 feet, fire holes or cross channels being formed from one side of the heap to the other corresponding to the upright stakes. The meiler being complete, the stakes are withdrawn, leaving a number of vertical flues in communication with the central horizontal flue or fire channel, as well as the cross fire holes or flues. A covering is then laid on, composed of clay, sand, and chopped straw or grass, the latter being added to prevent the covering from cracking. This mixture is prepared in two boxes or pits, one at each side of the heap, and a portion of it should always be kept ready to stop up any cracks which may form in the coating during the carbonization. Plugs should be prepared for stopping up the orifice of the main fire channel, and of the cross or lateral ones, for all openings to the windward should always be kept closed, the channels at the other side being sufficient to provide air to maintain the carbonization.

Everything being ready, the firing commences, for which two workmen are required, who ignite at the orifices of the main fire channels at

each end of the heap, the brushwood laid along its whole length. When the turf is fully ignited throughout the mass of the meiler, a thick black smoke is evolved from the chimneys; as the charring proceeds, it thins, and gradually assumes a greyish white colour. In proportion as the moisture of the turf evaporates, the greyish white smoke also thins, and assumes a blueish appearance, and a strong sulphurous smell. The moment that the whole of the vapour has passed off, the fire must be gradually choked; this point is easily ascertained by holding the hand from time to time over the chimneys, if all has passed off, it will remain dry, if not it will condense on the hand.

The peat charcoal carefully made in this way, is of excellent quality, and has and is being largely used in Saxony and Bohemia, in metallurgical operations. As in all other instances, the cost of the charcoal depends very much upon the cost of the turf, and it is very difficult to separate the latter element from the cost of carbonization. We know of one instance where the charcoal produced by the system of meiler or heap, cost only 13s. 8d. per ton; but we cannot say how much of that sum is to be set down for raw material, and how much for charring; we may, however, assume that the latter element was not more than in the case of the other methods noticed. Indeed the methods of charring in common use on the Continent, do not appear to differ very materially from each other in cost, judging from the estimates which we have given, and which, so far as the individual cases go, we have every reason to believe to be correct.

Having now brought so many methods of charring under the notice of our readers, it will be naturally expected that we should venture to give an opinion as to those which would be best suited for adoption in this country, or, in other words, to pronounce which were best. The choice appears to us to lie between three:—the furnace of Crouy-sur-Oureq, the Bohemian circular furnace, and the rick meiler or heap.

The French furnace offers several advantages; it is continuous, and each charge is rapidly carbonized, and so there is great economy of fuel. It is the best adapted for preparing peat charcoal on a great scale, where large capital could be applied to the manufacture. And if the charcoal, instead of being allowed to fall into a pit from the retort, was received in wrought iron waggons, which could be covered up tightly, and drawn away, and allowed to cool, the temperature of the retort need never be allowed to sink, and the operation would be as continuous as in making coal gas. The charcoal made in the system of close retorts, would not, however, be well adapted for metallurgical purposes, at least not as well as when made in some other forms of furnace, but it would be admirably adapted for deodorizing purposes. The Bohemian brick furnace produces admirable charcoal, dense and nearly as hard as wood charcoal, and therefore well fitted for smiths' use, and for metallurgical operations generally. This furnace has, however, the disadvantage of not being continuous, and however well adapted for small works, it is not so well suited for an extensive manufacture of charcoal by capitalists. A farmer or small proprietor who could erect two or three of these, might, if peat

charcoal became an article of general consumption, make a considerable profit. But in the present state of the trade, we fear that any person who would take up the manufacture of peat charcoal, should do so as people do in any other branch of industry. On the whole, however, we believe this system of furnace gives the best results, where it is intended to carry on the operations on a small scale, with a little capital.

The meiler system has the great advantage of requiring almost no capital at all; the manufacture of peat charcoal in this way, may therefore be taken as an example of a manufacture without capital. The charcoal made by it is excellent, and a large quantity may be prepared at once, which is important. To char turf in heaps requires, however, much more skill than to char wood, for, in the first place, turf does not ignite so readily as wood; 2ndly, it does not conduct the ignition through the mass so rapidly; 3rdly, it contracts more in the charring; and 4thly, it takes a longer time to go out. With attention and some experience, these difficulties may be got rid of, and a lucrative trade created, well adapted to the circumstances of the poorer people.

There is, however, a drawback to the rapid extension of the peat charcoal manufacture upon the system of small producers, which is this, that the product obtained in the charring of turf consists of whole pieces, and of broken fragments and powder; on the Continent the former would find a ready market for kiln drying malt and other grain, and especially for smiths' use, and metallurgic operations generally; in Ireland there would be no market, for the manufacture of malt is not a household occupation, and is entirely confined to the larger towns, where coal can be obtained cheaper than peat charcoal. The small manufacturer would, therefore, have to crush the whole of his product, in order to bring it into the condition in which it is required for deodorizing purposes, and having done so, he would have to sift it, in order to separate the dust from the granulated portion; the latter being the condition in which it has the greatest deodorizing powers, whilst the dust is of great value for sprinkling over the surface of the moulds in metal casting. To perform both these operations effectively and economically, a certain amount of machinery becomes necessary, and thus necessitates capital. If, on the other hand, there was a considerable manufacture of hardware, such as buckles, stirrups, bits, files, nails, screws, hinges, bolts, locks, &c., for which peat charcoal is admirably adapted, the whole pieces would sell to advantage to the smiths, and the powder might be sold at a cheap rate without further preparation, for deodorizing purposes.

Three Bohemian furnaces with small mill, somewhat on the principle of a coffee mill, and a bolting cylinder for separating the dust, tools, and every other requisite for a small charring establishment, capable of producing at least 12 tons of charcoal per week, might be erected for £300 to £350, a sum quite within the means of hundreds in this country.

We have now, we believe, satisfactorily established, that it does not require great companies, with London offices, secretary, resident director, and other officers, to make peat charcoal; and that there is a wide field of

industry available for those possessed of a little capital and persevering industry, from which the public would benefit directly and indirectly. We shall return to this subject again, in order to show what is being done on the Continent in the manufacture of iron, with peat and peat charcoal.

ART. IV.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

MINING, METALLURGY, ETC.

Machine for washing Coal.—The great advantage of purifying coals for most manufacturing purposes, and of utilizing the inferior portions of coal seams, is now strongly felt, if we may judge by the number of machines which have been proposed to effect the removal of the impurities. We have already called attention to the one of Berard,* and we shall now mention that proposed by M. Froehlich. This machine is simple in the extreme. It consists of a large circular cistern coopered in the ordinary way, in which a wooden framework or agitator is made to revolve by means of an upright shaft driven by suitable gearing. The bottom is dished, and in its centre is a hole, to which a sort of cast-iron conical pocket is fitted, the lower end of which is closed by a valve opening downwards into a canal with a bottom of wire gauze. Immediately above the bottom three pipes enter at equal distances from one another, for the purpose of supplying a constant flow of water. A little above the level of those, at one side, is a rectangular opening provided with a valve, which opens upon another canal with a wire gauze bottom. The cistern is kept about three-quarters full of water; and the small coal, carried up by a chain lift or other mechanism, falls by means of a hopper into the water. The motion of the agitator causes the fragments to describe curves of more or less length, and this allows time for them to arrange themselves according to their specific gravity. The fragments of schist and pyritic coal, being much heavier than the pure coal, fall at once on the inclined bottom, and then through a grating pass into the pocket above mentioned, which is emptied from time to time by means of the valve. The fragments of pure coal escape with the water through the rectangular opening, and fall upon the grating, which has an oscillating motion, which serves to project the coal into a waggon or vehicle, whilst the water escapes through the grating.

Two men would be sufficient to work a cistern of about 40 inches high and 40 inches in diameter, and capable of washing about 20 metrical tons in the day with a force of one horse. A cistern of about 9 feet 10 inches in diameter and depth would wash 200 tons in the day, and would require a force of 10 horses to work it. The smaller machine would cost about £80, and the larger about £400.—*Bulletin de la Société Industrielle de Mulhouse*, No. 123, p. 292.

M. Picault's mode of making Razors.—He first prepares plates of cast-steel, laminated to the thickness which the blades are to have, and having two opposite sides forged to a coarse edge. These plates are placed under a shears, which at one cut produces a blade. Upon these blades M. Picault stamps his mark, and by the aid of a cutting hammer he impresses a number of striated or grooved lines upon the two surfaces of the blade where it is to be fitted into the back. The back itself is formed of soft cast-iron, planed and polished so as to retain none of the roughness of the casting. A groove is formed by a simple mechanical process in one of the edges, and into this is fitted the blade previously prepared. The blade and back thus joined are placed in a swage or stamp having the form of the back, and subjected to a considerable pressure by means of a lever, the effect of

* *Journal of Industrial Progress*, No. I., p. 19.

which is to fix the blade in the groove, where it is held tightly by means of the grooves cut in the blade as already mentioned, and into which the soft cast-iron is as it were squeezed. There only remains the operation of grinding to complete the razor, and this is done exactly in the same way as with razors formed in one piece.

This system of manufacture appears to offer the following advantages: 1stly, as to economy, in the reduction by nearly one-half of the weight of steel employed; in the fuel and labour at the forge, which becomes in this method insignificant; in the absence of any operations of filing down, &c., inasmuch as each blade comes from the shears fully formed; and in the rarity of failure in the operations of tempering, owing to the almost uniform thickness of the blades, which allows them to be heated to the exact point necessary for a good temper, and to cool more equally in the water. 2ndly, as to quality in the steel employed; in the simplicity of the forging, which is confined to the closing up of the pores of the steel upon the cutting edge of the blade, and does not necessitate the subsequent evils of cutting away the hardened surface which thick blades require; and in the fact, that in the operation of tempering, the blade being of an almost uniform thickness, the cutting edge is not subject to be burnt as in the ordinary process. The idea of applying artificial backs to razors is not new, but hitherto the methods proposed to effect it have been unsuccessful, whilst M. Picault has completely resolved the problem. The only objection which can apparently be raised against his system of manufacture is, that the joining of the back and the blade may retain humidity, and rust after some time. This objection would, however, apply to all razors with artificial backs, and may be obviated by a little care in using them.—*Bulletin de la Société d'Encouragement*, Sept. 1853, p. 499.

Influence of Bismuth upon the ductility of Copper.—M. Levot has shown that Bismuth, even in very small quantities, exerts a very injurious action upon the ductility of copper. An alloy of pure copper, with $\frac{1}{100}$ of its weight of bismuth, had a crystalline texture, and a well marked grey tint, and was torn under the hammer. A second alloy, formed of pure copper, in the state of very fine wire, with $\frac{1}{1000}$ of bismuth, had also a crystalline texture, and had but a very slight ductility. He was led to make these experiments by the analysis of some specimens of black copper from Australia, which presented unusual difficulties in the process of refining, and which, he discovered, contained 0.144 per cent. of bismuth, and even when refined still contained 0.048 per cent., and was of very inferior quality. He directs attention to these results, as pointing out the necessity of looking for traces of bismuth in the copper of commerce, and thus avoiding many disagreeable results, which have frequently ensued from the employment of certain coppers; and which, he appears to think, are attributable in many instances to the presence of traces of bismuth.—*Bulletin de la Société d'Encouragement*, December, 1853, p. 748.

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

Rotary Drying and Tenting Machine.—T. W. Kennedy, of Augusta, Virginia, United States, has obtained a patent for a new and highly useful rotary machine for drying and tenting cloth. The invention consists in stretching the cloth on two spiral series of tenter hooks attached to the faces of two wheels or open discs, which are placed upon the same shaft and receive a rotary motion. The piece of cloth being stretched between these two series of hooks is made to assume a convolute form, but a sufficient space is left between the volutions for the free circulation of air, which is drawn in through the open discs at the sides when revolved, while the moisture is thrown off at the circumference. The revolution of the cloth on this spiral wheel, and the rapid circulation of air between the volutions of cloth, soon repels all moisture. A central drum on the shaft to contain hot air or steam, also aids in drying the cloth rapidly, as the currents of air which are driven through the cloth are thus heated. The rims on which the tenter hooks are secured are capable of being moved on the shaft nearer to or further from one another, for the purpose of hooking on the cloth and then stretching it, and also to suit different breadths of cloths. This machine is a modification of the ordinary centrifugal drying machine adapted for woollen goods, and appears to be a really useful one.—*Scientific American*, April 15th, 1854.

Improved Woollen Condensers.—James S. Hogeland, of Lafayette, Indiana, United States, has obtained a patent for an improvement on woollen condensers of the reciprocating kind. In the ordinary machine the slubbing or roping as it comes from the card is compressed lightly upon the surface of the rub-roller by the reciprocating rollers above. It often happens therefore that the roping adheres to the rub-roller with sufficient force to be drawn round by it until broken away from the spool, which not only renders it necessary to stop the machine, in order to mend the break, but also causes a frequent waste of the adjoining slubbings, by their entanglement with the broken one. This difficulty increases with coarse or burry wool, for the direct transmission of the slubbing or roping from the rub-rollers to the spools is almost always impeded by the unequal adherence of the wool to the rub-roller, which in rotating is apt to carry the coarser or more burry or gummy adhering roping, round with it, or at least partly so, by drawing it out of its direct course, thus unequally deflecting the roping in its course to the spool; the result of which is, that it is unequally drawn, and wound upon the spool irregularly, and when much inequality in the draw occurs, the folds of the roping are in danger of becoming entangled on the spool. It sometimes also happens that a further difficulty is produced by the roping having wound round the rub-roller instead of the spool. Mr. Hogeland's invention consists in the employment of relief and guide rollers on the delivery side of ordinary rub-rollers, and revolving in the same direction, and the relief roller being almost in contact with the rub-roller. By this contrivance the tendency of the roping to adhere to the rub-roller is counteracted, as it has but little, if any, tendency to stick to the relief-roller, for it is not compressed on it, as it is upon the surface of the rub-roller, by the pressure of the rubbers. The slubbing or roping will therefore be continued in a direct line, or nearly so, from the upper portion of the periphery of the relief-roller to the spool. Besides avoiding the accidents above indicated, the use of the relief-roller has a great advantage in keeping the roping in its proper course to the spools, when the wool is filled with electricity, which all those who work in wool know is very difficult to do, especially in frosty weather.

One of the chief advantages of this system is, that it can be at once applied to existing machinery, without any modification being required. Each rub-roller of the condenser is simply furnished with a relief and guide-roller. The relief roller may be driven by the same belt or band that communicates motion from the rub-roller to the spool drum, or by any other suitable means.

Mr. Hogeland states that he has now had this improvement in constant use eighteen months, and has had the fullest satisfaction from its use. It enables him, with the same machinery, with no other alteration, save the relief-roller, to do twenty per cent. more work.—*See Scientific American, April, 1854.*

Improved Excavator.—A. D. Brown, of Opelika, Walker County, Georgia, United States, has made an excavating machine, which is said to be much simpler and cheaper than any of those hitherto proposed, and requires but little attendant labour. Further details are not yet stated.—*Savannah Journal, through Scientific American, April, 1854.*

Improved Car Truck for Railways.—Cornelius Brooks, of Albany, State of New York, has patented some arrangements of the axles of car trucks which appear to be novel. The invention consists: 1st, In attaching each wheel of a truck to a separate axle, and securing the two axles of a pair of wheels together by means of an encircling clamp. One of the axles is hollow and receives the other axle. Each wheel of a pair is free to move of itself. Around the axle of each wheel there is a collar box having friction rollers, and the axles are attached to these collar boxes by diagonal rods. 2nd, There are guide wheels on each truck, which when they meet an obstruction rise over it (being secured to springs) and then descend on the rail again before the centre bearing wheels meet the obstruction. The object of these arrangements is to allow the cars to move more freely in turning curves and passing over obstructions or inequalities of the track.—*Scientific American, April, 1854.*

Method of forming Moulds for casting Cog-wheels without the necessity of making a complete model.—M. Ferrouilh is able to cast cog-wheels of all dimensions, without making a complete model, in the following simple manner. He

first constructs a large flat circle, and divides its circumference into as many divisions as the wheel is to have teeth. This circle, which is larger than the intended wheel, and may be used for any sized wheel smaller than itself, having the same number of cogs, is laid upon the mould, in which the centre part of the wheel has been formed in the ordinary way by a model, for it is only the circumference and the cogs of which there is question here. In the exact centre of the mould, which must also be made the centre of the graduated circle, a cylindrical pin is fixed perpendicularly, upon which an arm or index, reaching beyond the graduated circle, is made to turn round. This arm has a narrow slot running along the greater part of its length, in which a simple mechanism, composed of two elements of the model bound together, so as to form in the space included between them the exact dimensions of one of the intended teeth of the wheel, is made to slide. When a wheel of any given dimensions is to be made, this little mechanism is fixed upon the arm, at a point corresponding to the diameter of the wheel to be made; the two elements of the model being held together only by a pin, may be readily separated from each other, and are indeed, when the mechanism is moved round after the formation of one cog. The whole being arranged in this way, the arm is placed in an exact line with one of the divisions of the circle, the model of the cog fixed in its proper place in the slot, which may be graduated so as to show the diameter of the wheel. The workmen then proceed to form the mould for one of the cogs in the sand, and when completed, the two elements of the model are taken asunder, and the arm moved on to another division of the circle, and another tooth formed. In this way an equally good and perhaps even a more accurate wheel may be made than with a complete mould, and with no more than ordinary care. The whole apparatus is made of wood, may be easily constructed, and is very cheap. We believe it is well worth the attention of millwrights.—*Bulletin de la Société d'Encouragement*, Nov., 1853, p. 693.

Briet's Gazogene Apparatus.—M.M. Mondolot, of Paris, successors of M. Briet, have made an improvement in the gazogene apparatus which bears the name of the latter, by surrounding the upper vessel with an outer one or jacket, fitted with a cover. The space between the case and the enclosed vessel may be filled with ice or with cold water, into which refrigerent mixtures may be put. In this a much more agreeable summer beverage may be prepared than with the original apparatus.—*Le Génie Industriel*, Jan., 1854, p. 1.

MANUFACTURES FROM MINERAL SUBSTANCES.

Manufacture of Laminated Bitumen.—M.M. Aumétayer & Co., of Paris, have patented an ingenious method of obtaining bitumen or asphalt in the form of thin sheets, which is worthy of attention in damp countries. The materials employed are of the best description, such as the asphalt of Seyssel, reduced to very fine powder, and the tar derived from the distillation of asphalt substances, principally from Bastennes. These substances are fused together, and in a fluid state come upon a kind of canvas, or rather fine netting, which immediately passes between two metal drums, placed at any required distances apart, according to the thickness of the sheet of asphalt, by which it is perfectly laminated. One or both sides of the tissue may be covered in this way. Numerous applications of such a material will at once suggest itself to every one. For example, it may be employed as a lining for damp walls, by fastening it on with a mixture of white lead, varnish, &c. in drying oil, to which may be sometimes added, a little pitch or tar in very damp places. It may also be employed for the walls or floors of cellars, basements, terraces, arbours, and rustic temples, water reservoirs. When properly made, it admits of being painted with great facility, and may in that way be highly ornamented. In no country would the use of bitumen be attended with more benefit than in Ireland, and yet, strange to say, it is scarcely ever employed. This process of the Messrs. Aumétayer, if carried out in these countries, would, no doubt, do away with the difficulties which have hitherto stood in the way of its more general use, and we accordingly strongly recommend the idea to some of our readers.—*Bulletin de la Société d'Encouragement*, No. 2, Jan., 1854, p. 47.

IMPROVEMENTS AND INVENTIONS CONNECTED WITH CHEMICAL PROCESSES.

Purification of Fixed Oils, especially of Olive Oil for Watch Makers.—The colourless olive oil which is used by watchmakers is exceedingly dear, and yet the process of its purification appears to be so simple, that any watchmaker may prepare it himself. If common olive oil be mixed with an equal quantity of very strong spirits of wine (sp. gr. 0.853) and allowed to stand for about fourteen or fifteen days, during which time it must be repeatedly shaken; already, in the course of a few days, the yellow colour of the oil begins to disappear, and then gradually fades until, at the end of the period mentioned, the oil becomes colourless. If the mixture be exposed to the direct action of the sun, this change takes place much more rapidly. The under layer of oil is separated from the spirit, which floats upon it, and preserved in well closed bottles (stoppered, or with plugs of wood or gutta-percha); the spirit may also be preserved for another operation, or if large quantities be employed, it may be distilled after each operation. The removal of the colour is not the only advantage which is gained by treating olive oil with alcohol, for a considerable quantity of the margarine which it contains is also dissolved out, and hence oil so treated will not solidify so readily as the raw oil. The process just described, and which is undoubtedly better than treatment, first with sugar of lead, then with sulphuric acid, washing with boiling water, and drying with chloride of calcium, or any of the other processes in common use, is applicable, more or less, to all other oils, even to coarse fish oils. It may be of importance to painters in oil, who are anxious not to injure the delicate tints of ultramarine, rose, scarlet, and other delicate shades of red, and in fact of all pure tones, that linseed oil, even the darkest and muddiest, may be so far bleached as to become bright and clear, and have only a slight yellow tinge; a good deal of oil is now purified in this manner in Great Britain.—*Würzburger gemeinnützige Wochenschrift*, 1854. No. 3, through *Polytechnisches Journal*, Bd. cxxxi. Hft. 2 Jan., 1854.

Bleaching by Steam.—At the Hotel St. Nicholas, at New York, from 3,000 to 5,000 pieces of linen are required to be washed daily. One man and three women perform this apparently enormous labour, with the aid of a very simple apparatus. This consists of a cylinder of wood, of about 4 feet in diameter, and $4\frac{1}{2}$ feet long, provided with an axle, and mounted upon a frame, and capable of being set in revolution by means of a small steam engine. The axle is hollow, and is placed in connection with different pipes, in such a way, that steam, hot and cold water, may be successively introduced into the drum; this being first half filled with water, a trap or hand hole is opened, and from 300 to 500 pieces of linen introduced, and a proportionate quantity of soap and of potash or soda ley. The trap is then shut and the cylinder slowly turned, first in one direction, and then in the other. This alternate motion plunges the linen into the water, then out of it against the walls of the drum. This operation finished, the ley is run off, and steam admitted for about fifteen to twenty minutes, the waste steam being allowed to escape by another pipe. Hot water is now introduced, obtained from the condenser of the engine, and finally cold water, which, by means of a few turns of the machine, completely rinses the goods.

When the pieces of linen have drained they are introduced into a centrifugal machine, which is made to revolve from 1,000 to 1,800 revolutions per minute, and in which they are dried in six or seven minutes. They are next suspended upon frames, and introduced into a stove heated by a steam pipe, where they are perfectly dried.—*Victor Meunier*, in *La Presse*.

DYEING AND THE PREPARATION OF COLOURS.

Production of brilliant and fast Colours with Garancine.—M. Edouard Schwartz, in some experiments which he made to test the solubility of the colouring matter of madder flowers and garancine in fixed oils, found that the cause why the latter does not yield as fast and brilliant colours as madder, is owing to its retaining traces of acid. And M. Schaeffer obtained the most satisfactory results by macerating one part of garancine with three parts of ammonia for several hours, and evaporating the mixture to dryness to get rid of all free ammonia. The colours

produced with this dried substance were excellent, and bore the action of soap perfectly; the pinks and lilacs had the peculiar blueish shade which is always present in madder dyes, but which is not produced by garancine employed in the ordinary way. The fact of the solubility of the colouring matter of madder in fixed oils, ascertained by M. Schwartz, is at present of little practical importance.—*Bulletin de la Société Industrielle de Mulhouse*, No. 122, pp. 180 and 184.

Reserves for Steam Colours.—For a long time calico-printers have employed certain means of preventing colouring matters from attaching themselves to particular parts of the goods destined to form parts of the pattern, either of a chemical or mechanical character. This style of printing has been much employed of late for steam colours, as well on cotton as on woollen and mixed goods, the colours usually reserved being orange, gray, white, &c. But hitherto no one, so far as we know, has succeeded in reserving, by any other than by mechanical means, greens, crimsons, and garnet colours of a certain intensity. M. Jules Albert Hartmann has, however, proposed a reserve, which acts both chemically and mechanically, and answers exceedingly well for steam greens, garnets, crimsons, and violets, upon cotton; and for garnets and crimsons upon woollens and mixed goods; but it does not reserve deep greens, except where very little indigo lake, or sulphate of indigo enter into their composition. It is, however, very difficult to reserve any colours upon wool, in consequence of the affinity of that material for colouring matters, especially orchil and indigo lake.

M. Hartmann's reserve is alumina precipitated, washed and dried in a warm chamber. The following are the formulæ which he has proposed:—One part by measure of powdered dried alumina, and one of finely sifted chalk, worked up with one and a-half parts of a solution of gum senegal. No. 2, the same as No. 1, but worked up with only half the quantity of gum water. No. 3, the same as No. 1, with the exception that, instead of one part of chalk, there be only one-half part of chalk and one-half part of pipe-clay. In these reserves the chalk decomposes the saline solutions which perform the functions of mordants, whilst the alumina fixes the colouring matter before it can reach the tissue, the combination thus formed, in virtue of its consistence, subsequently serving as a mechanical reserve.—*Bulletin de la Société Industrielle de Mulhouse*, No. 123, p. 281, 1854.

IMPROVEMENTS IN THE MANUFACTURE OF TEXTILE FABRICS.

On a new process for the preparation of the Cocoons of the Silk-worm, and the winding off of the raw Silk, by MM. Alcan & Limet.—It is well known that the present process employed in drawing the silk from the cocoons is extremely imperfect; and that no matter what care is bestowed upon the operation, there is a considerable waste of material, whilst the process is anything but economical, and the silk is inferior and imperfect. Among these imperfections we may mention, a peculiar downiness and a diminution in the tenacity and elasticity of the filaments. Messrs. Alcan & Limet have invented a very ingenious process, which appears to obviate all these disadvantages.

The principle of this new mode of preparation is based upon the alternate action of steam, a vacuum, and hot water. The cocoons are placed in bags of netting and put into a kind of basket of wire gauze, which is suspended immediately over the surface of water, contained in a vat or circular vessel of zinc, and heated to a temperature of 188° Fahr. by a pipe pierced with holes, which conveys steam from a small boiler. A bell or cylinder of galvanized iron is then made to descend in the manner of a gasometer into the water covering the basket containing the cocoons. Steam is now made to act upon the latter by means of four upright tubes pierced with holes; this steam expels the air from the bell through a cock in the top. When steam issues freely from the cock in the top, it is closed and the steam shut off; a condensation takes place in the bell, which may be assisted by pouring some cold water upon its upper surface. A vacuum is thus produced, which causes the hot water to rise suddenly in the bell and penetrate the cocoons. This done, the cock in the bell is opened, whereupon the water in the bell again descends, and the cocoons are once more exposed for a few minutes to the action of the steam in order to dilate them. They are now prepared for

drawing, and are poured out into a basin; each net is shaken for a few moments, in order that the ends of the filaments may attach themselves to the meshes of the net, so that the winder is enabled to catch them by the hand alone, without the aid of the broom now used.

The following are the important results which are anticipated from this process:—1, Concentration in the hands of one person, no matter how important the establishment may be, of so delicate an operation as the preparation of the cocoons, from whence will result a regularity almost mathematical of the operation, a great saving in expense, and a perfect uniformity in the quality of the produce; 2, complete suppression of the broom in the operation of drawing, and consequently less ravelling and piercing of the cocoons, whilst the gathering of the ends of the filaments will be more easily effected; 3, an increase of 10 per cent. of raw silk over the system now in use; 4, the production of a silk without down, more regular, of greater lustre, more elastic, more tenacious, and consequently of proportionally greater value; 5, the drawing being performed at a temperature below that now employed, a saving of fully 50 per cent. in fuel, and 20 per cent. in cost of drawing will be effected; 6, absence of all vapour in the apartment, and consequently of all injurious effects upon the work-people, and the possibility of drawing at every season, and in every country, without inconveniencing the person employed, at the same time that there is a diminution of the general expenses; 7, *the mode of preparation restoring to the cocoons their original forms, cocoons may be drawn indiscriminately, and with equal success, whether indigenous or imported from foreign countries, even when the latter come into commerce flattened*; 8, finally, the employment of this process scarcely necessitates any change in the existing plant of any drawing-house.

All these advantages put together, may be estimated as a mean at 18 to 20 per cent. An apparatus of this kind which would prepare the cocoons for 100 basins, and 100 drawing reels, could be made for about 200 to 300 francs (£8 to £12). An establishment of 50 basins worked throughout the year, could produce raw silk to the value of 250,000 francs (£10,000), the saving upon which, at 20 per cent., would be 50,000 francs (£2,000). All the advantages here stated, are said to have been fully and positively established at a model establishment at the Batignolles, near Paris.

These results are of vast importance to the silk trade, and although of more immediate value to France for the moment, they are destined to be of equal value in every other silk producing country. India will at once suggest itself to all our readers, and we accordingly recommend it to the notice of all those interested in that country.—See *Bulletin de la Société d'Encouragement*, No. 8, April, 1854, p. 240.

Employment of Wood in the manufacture of Paper.—M. Charles Cheron, of Heimsprung, near Mullhouse, states that he has succeeded in overcoming every difficulty in preparing wood so as to serve as a material in the manufacture of paper.—*Bulletin de la Société d'Encouragement*, No. 4, Feb. 1854, p. 127.

ART. V.—*Bulletin of Industrial Statistics.*

SHIPPING OF BELFAST COMPARED WITH THAT OF LIVERPOOL.

We extract the following statistics relative to the gigantic progress of Belfast, from that admirable organ of the trading interests of that town, the *Belfast Mercantile Journal*. And in doing so, we would ask, why it is that similar statistics are not compiled for every other town in Ireland? This is surely the duty of local boards, and we hope that the subject will henceforward be attended to.

Table of comparison between the Shipping and Tonnage of Liverpool and Belfast, from the Year 1800 to 1853, inclusive.

Years.	No. of Vessels that entered Liverpool.	No. of Vessels that entered Belfast.	Tonnage of Liverpool.	Tonnage of Belfast.	Periodical Increase of the No. of Vessels that entered Liverpool	Periodical Increase of the No. of Vessels that entered Belfast.	Periodical Increase in the Tonnage of Liverpool.	Periodical Increase in the Tonnage of Belfast.
1800	4,746	777	450,060	53,268	1810 to 1819 over 1800 to 1809, 24 per cent.	1810 to 1819 over 1800 to 1809, 38 per cent.	1810 to 1819 over 1800 to 1809, 30 per cent.	1810 to 1819 over 1800 to 1809, 45 per cent.
1801	5,060	763	459,719	54,338				
1802	4,781	825	510,691	58,724				
1803	4,791	920	484,521	65,498				
1804	4,291	892	448,761	71,173				
1805	4,618	840	463,482	69,582				
1806	4,674	960	507,825	80,326				
1807	5,791	915	662,309	80,420				
1808	5,225	1,005	516,836	83,638				
1809	6,023	1,004	594,601	74,387				
	50,002	8,901	5,108,805	693,354	1820 to 1829 over 1810 to 1819, 52 per cent.	1820 to 1829 over 1810 to 1819, 60 per cent.	1820 to 1829 over 1810 to 1819, 67 per cent.	1820 to 1829 over 1810 to 1819, 84 per cent.
1810	6,729	1,105	734,391	95,211				
1811	5,616	1,047	611,190	93,753				
1812	4,599	1,377	446,788	117,291				
1813	5,341	1,190	547,426	97,670				
1814	5,706	1,159	548,967	90,486				
1815	6,440	1,154	709,849	91,371				
1816	6,888	1,060	774,243	88,770				
1817	6,079	1,238	653,425	73,959				
1818	6,779	1,429	754,690	127,263				
1819	7,849	1,500	867,318	131,590				
	62,026	12,259	6,648,277	1,009,304	1830 to 1839 over 1820 to 1829, 46 per cent.	1830 to 1839 over 1820 to 1829, 36 per cent.	1830 to 1839 over 1820 to 1829, 59 per cent.	1830 to 1839 over 1820 to 1829, 51 per cent.
1820	7,276	1,477	805,033	127,335				
1821	7,810	1,533	839,848	136,495				
1822	8,156	1,705	892,302	153,500				
1823	8,916	1,760	1,010,819	152,437				
1824	10,001	1,973	1,180,914	175,294				
1825	10,837	2,060	1,223,820	183,441				
1826	9,601	2,102	1,228,318	209,252				
1827	9,592	2,144	1,225,313	219,148				
1828	10,703	2,390	1,311,111	241,568				
1829	11,383	2,493	1,387,957	257,522				
	94,265	19,637	11,106,035	1,855,992	1840 to 1849 over 1830 to 1839, 35 per cent.	1840 to 1849 over 1830 to 1839, 40 per cent.	1840 to 1849 over 1830 to 1839, 63 per cent.	1840 to 1849 over 1830 to 1839, 60 per cent.
1830	11,214	2,423	1,411,964	246,493				
1831	12,537	2,273	1,592,436	230,107				
1832	12,928	2,300	1,540,057	241,643				
1833	12,964	2,487	1,540,461	266,014				
1834	13,444	2,704	1,692,870	284,601				
1835	13,941	2,750	1,768,426	290,769				
1836	14,959	2,819	1,947,613	309,266				
1837	15,038	2,724	1,958,984	288,143				
1838	14,820	2,955	2,026,206	298,278				
1839	15,445	3,350	2,158,691	354,542				
	137,290	26,765	17,687,708	2,809,846	1850 to 1853 over 1840 to 1849, 2 per cent.	1850 to 1853 over 1840 to 1849, 25 per cent.	1850 to 1853 over 1840 to 1849, 13 per cent.	1850 to 1853 over 1840 to 1849, 27 per cent.
1840	15,998	3,323	2,445,708	361,473				
1841	16,108	3,578	2,425,461	357,902				
1842	16,458	3,549	2,425,319	337,505				
1843	16,606	3,570	2,445,278	303,038				
1844	18,411	3,655	2,632,712	445,537				
1845	20,521	3,888	3,016,531	492,569				
1846	19,951	4,108	3,056,414	547,862				
1847	20,889	4,213	3,351,539	628,523				
1848	20,311	3,905	3,284,963	596,953				
1849	20,733	4,080	3,639,146	555,921				
	185,986	37,529	28,763,101	4,502,374				
1850	20,457	4,490	3,536,337	624,113				
1851	21,071	5,016	3,737,666	650,938				
1852	21,473	5,221	3,912,506	684,156				
1853	20,490	5,711	3,889,981	768,505				
	83,491	20,438	15,076,490	2,727,712				

RAILWAYS OF THE UNITED STATES.

The following Table, containing some of the most important data connected with the American Railways in the end of the year 1853, will serve to complete the statistics of the United States, which we gave in No. IV. of this Journal.

	Number of Lines.	Completed, in English Miles.	In course of Completion, in English Miles.	Capital Expended in Dollars.
Alabama ...	6	221	659	3,636,208
Carolina, North ...	4	359	243	6,947,213
Carolina, South ...	9	661	288	13,287,093
Connecticut ...	15	669	83	20,857,357
Delaware ...	2	16	43	600,000
Florida ...	2	54	...	250,000
Georgia ...	15	884	445	17,084,872
Illinois ...	26	1,262	2,017	29,581,204
Indiana ...	19	1,127	868	22,400,000
Iowa ...	2	...	480	...
Kentucky ...	9	233	552	4,969,990
Louisiana ...	8	170	239	1,661,000
Maine ...	11	417	90	12,662,645
Maryland ...	3	597	30	26,024,620
Massachusetts ...	43	1,283	48	55,602,687
Michigan ...	3	570	41	16,659,009
Mississippi ...	4	155	436	3,070,000
Missouri ...	6	60	963	1,000,000
New Hampshire ...	16	512	34	16,185,254
New Jersey ...	11	437	...	12,736,505
New York ...	31	2,362	564	94,361,262
Ohio ...	46	2,609	1,582	50,775,344
Pennsylvania ...	64	1,464	987	58,494,675
Rhode Island ...	1	50	...	2,614,484
Tennessee ...	9	388	695	7,800,000
Texas ...	1	...	72	...
Vermont ...	7	410	59	13,866,195
Virginia ...	21	673	1,180	12,720,421
Wisconsin ...	4	178	200	3,800,000
Total ...	398	17,821	12,898	508,588,038

Besides this amazing network of railways, the United States of America has one of the most perfect systems of navigable rivers in the world. The single river, the Mississippi, with its immense tributaries, present a water-way, navigable for considerable steamers, of 16,674 miles, and waters 1,200,000 square miles; whilst the great chain of lakes, one shore of which only belongs to the United States, gives a coast line of 3,000 miles. Some idea may be formed of the importance of this coast line, when it is told, that in 1849, the Americans possessed 1,208 sailing vessels and steamers upon the lakes, reporting a tonnage of 192,982 tons, and manned by 10,500 sailors. These vessels transported in that year 6,500,000 tons, and 425,000 passengers! From these facts we may assume that in a few years the United States will possess the most perfect system of internal communication which has ever existed in any country in the world.

The striking contrast presented by the progress of the United States with the state of things in Europe, notwithstanding that the latter has enjoyed a considerable amount of prosperity of late years, shows to great advantage the benefit of really free institutions. While the resources of America are being devoted to education and the development of commerce, those of Europe are squandered in playing at soldiers or destroying liberty.

STATISTICS OF THE PRIZES ADJUDGED AT THE EXHIBITION OF NEW YORK IN 1853.

Table showing the ratio between the number of Exhibitors and the number of Prizes, according to the Nation.

Nations.	Silver Medals.*	Bronze Medals.	Honorable Mention.	Total.	Number of Exhibitors.	Per-Centage of Exhibitors who received Prizes.	Number of Exhibitors to 100 Prizes.
United States ...	82	458	598	1,138	1,955	58	172
Zollverein and the other German States }	5	113	146	264	638	41	244
Gt. Britain & Ireland	10	129	111	254	456	54·8	182
France ...	18	144	105	267	396	67·4	148
Austria & Lombardy	1	31	32	64	297	21·5	465
Canada ...	—	10	26	36	149	24·	416
Italy ...	1	46	47	94	220	42·7	234
Holland ...	1	22	37	60	141	42·	238
Switzerland ...	—	22	17	39	103	37·6	264
Belgium ...	—	11	16	27	55	49·	204
Total ...	118	986	1,135	2,239	4,410		197

The proportion of prizes to exhibitors is certainly remarkable, fully one-half having displayed in their goods sufficient excellence to call for special mention, if not deserving of a medal. We do not recollect any similar exhibition, in which presumed excellence ranged so high. If these prizes were really given only on proof of special excellence or novelty of invention, the New York Exhibition was a better representation of industry than the number of exhibitors would indicate.

An examination of the preceding table shows, that the superior excellence shown by the French manufacturers at the London Exhibition of 1851, was fully maintained at New-York. And if we calculate the proportion between each class of rewards and the number of exhibitors, we shall find that there too France was in the first rank. The following table shows this:—

Silver Medals.	Bronze Medals.	Honorable Mention.
France ...45 ¾ cent.	France ...36 ¾ cent.	United States ...31 ¾ cent.
United States ...42 "	Great Britain } 28 "	Belgium ...29 "
Great Britain } 22 "	and Ireland }	France ...27 "
and Ireland }	United States ...24 "	Holland ...26 "
Zollverein ... 8 "	Switzerland ...21 "	Great Britain } 24 "
Holland ... 7 "	Belgium ...20 "	and Ireland }
Italy ... 4 "	Zollverein ...18 "	Zollverein ...23 "
Austria ... 3 "	Holland ...16 "	Italy ...21 "
	Italy ...15 "	Switzerland ...17 "
	Austria ...10 "	Austria } each 11 "
	Canada ... 7 "	Canada }

* The highest recompense, there being no gold medals.

THE

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No. VIII.—AUGUST, 1854.

ART. I.—*The War, as it affects Irish Flax production.* By JAMES MACADAM, JUNR.

RUSSIA, as a great agricultural country, has for many years furnished these islands with large quantities of certain articles of general use, the sudden cessation of whose import has materially affected different branches of our trade. The chief items of this import have been grain, flax, flax seed, hemp, and tallow. With the second and third of these only we now propose to deal, in considering the influence which the existing war may have upon the cultivation of the flax plant in Ireland.

From a table lately presented to Parliament, we learn the proportion which Russian flax bears to that derived from all other countries, as the supplementary aliment of the linen manufacture of these kingdoms. That table embraces the ten years from 1844 to 1853, inclusive. During this period the supply of flax from Russia has fluctuated from 34,058 tons in 1847, to 64,742 tons, in 1853. Dividing these ten years into two given quinquennial periods, we find the average annual import from Russia, as compared with that from other countries, to be as follows:—

Average Annual Import of Flax into Great Britain and Ireland.

From	Five years ending 1848.		Five years ending 1853.	
	Tons.		Tons.	
Russia ...	...	44,789	...	56,565
All other countries ...	...	21,855	...	24,652
		66,644		81,217
	Total	66,644	...	81,217

It thus appears that the quantity annually obtained from Russia in the first period was $67\frac{1}{4}$ per cent. of the entire importation, and in the second period $69\frac{3}{4}$ per cent.

As regards the value of these imports, the quantities given do not show the relative cost. Russian flax is, with the exception of the Egyptian and some of the Prussian, the coarsest flax of commerce. Its average value

may be put at £40 per ton, while, even allowing for coarse qualities from the other countries named, the fine flaxes of Belgium and Holland would raise the average value of the rest to about £70 per ton. The yearly cost therefore would stand thus:—

	1st Quinquennial period.		2nd Quinquennial period.
Russia ...	1,791,560	...	2,262,600
All other countries ...	1,529,850	...	1,725,640
		...	
Total	3,321,410	...	3,988,240

So much for the fibre. Next as regards the seed. It will be sufficient in this item to take one year, say 1851. In that year there was imported into the United Kingdom of flax-seed both for sowing and crushing:—

From	Quarters.		Value.
Russia ...	417,951	...	£919,492
All other countries ...	212,520	...	467,544
Total	630,471		£1,387,036

Thus we see, putting both the products of the flax plant together, that we are now yearly indebted for these useful articles—

To Russia for	...	£3,182,092
To all other countries...		2,193,184
Total	...	£5,375,276

A total of nearly five millions and a half sterling, for what Ireland could produce with profit and advantage, not only to the extent of the import—except some very fine flaxes of Belgium,—but also for export to France, Belgium, and other countries, which now derive a considerable proportion of the supply of their coarse flax from Russia. France, for example, imports 14,000 tons annually from that country, and Belgium, 2,300 tons.

It is evident that the consumption of flax has very much increased of late years in Great Britain and Ireland, for we find that while the annual importation of foreign sorts had risen from 66,644 tons, in the first five years, to 81,217, in the last five, the production in Ireland had also risen in the same interval, from a yearly average of 14,000 tons, to an average of more than 30,000 tons. Thus, in round numbers, the quantity of flax fibre consumed in the linen manufacture of Great Britain and Ireland, was from 1843 to 1848, 80,000 tons annually, and from 1849 to 1853, 110,000 tons. To this consumption, foreign flax contributed in the first period $82\frac{1}{2}$ per cent., and in the second $73\frac{3}{8}$ per cent.. The home production has therefore been gaining ground on the foreign supply; and last year Ireland furnished 44,000 tons, while foreign countries contributed 94,000, so that the proportion of the latter to the entire consumption of 1853, was reduced to 68 per cent.

It is much to be regretted, however, that with the great acknowledged capabilities of our island for the production of flax, the United Kingdom is still so largely dependant upon foreign states for this raw material, and more especially so, since so great a proportion of the extraneous supply is from a country like Russia, whose political constitution is so much at

variance with ours, as continually to threaten an interruption of relations, while her commercial system is so restrictive as to deprive us of the benefit of exchanging our manufactures for her agricultural productions. In order to ascertain the extent to which flax might be grown in Ireland as a part of the regular cropping rotation, some facts may now be put forward. The entire quantity of flax grown in 1853 was 175,495 acres, or one to every 76 of arable land. Of this area, Ulster gave 161,216 acres, or one in every 21 $\frac{1}{4}$ of arable land. Had the other provinces produced flax in a similar proportion, the quantity grown would have reached nearly 600,000 acres. But in Ulster itself we find some counties producing much less flax than the rest. Six counties of that province varied from 1 acre of flax in every 13 of arable land to 1 acre in every 18; Cavan had 1 acre in every 31; Antrim 1 in 43; and Fermanagh 1 in 72. Taking Donegal, Derry, Monaghan, and Armagh, as the four greatest flax growing counties, we find that an acre of flax is there grown to every 15 of arable land. Supposing all the rest of Ireland to grow the plant in the same proportion, we should have a total area of nearly 900,000 acres. But, as in many districts the soil is less suitable for flax than for other crops, we may adhere to the figure of 600,000 acres as representing the probable annual area which Ireland might, with advantage, cultivate. Taking 5 cwt. as the average yield, this would furnish 150,000 tons of fibre, or about 40,000 tons over the present consumption of Great Britain and Ireland. It is very evident therefore that, were the growth of flax to extend to the limit pointed out, we could replace the entire import of Russian flax, and have a large surplus to export to France, Belgium, and other countries, now consumers of the Russian article. Putting this 150,000 tons at £45 per ton, average value, it would amount to £6,750,000.

But this is not all. Every acre of flax will yield one and a half quarters of seed. We have already seen that we import 630,000 quarters annually from abroad, and to this should be added about 80,000 tons of oil-cake, which represent 570,000 quarters more—say in all 1,200,000 quarters. At the above rate of yield, the Irish crop would give 900,000 quarters, which would supply the place of the foreign import, and leave a surplus for exportation. The value, at 48s. per quarter, would amount to £2,160,000, which, if added to the value of fibre, would give nine millions sterling, as the annual sum which Ireland might derive from the flax crop.

The object of the foregoing calculations is to show that the British and Irish linen manufacture might be rendered completely independent of Russia, and, to a great extent, of other countries also, for a supply of raw material, and that cattle-feeders of the sister island might also obtain all the oil-cake they require, made from Irish seed, if the cultivation of the flax plant were extended in Ireland, as it might be, throughout the length and breadth of the island. The Royal Flax Society of Belfast has been unremittingly labouring to this end since 1841, and it is most satisfactory to observe, that the area of flax has increased from 58,312 acres in 1847 to 175,495 acres in 1853; the provinces of Leinster, Munster, and Connaught having increased during the same period, from 4,611 acres to 14,279. Still, when we find the smallest county in Ulster—Armagh—

growing nearly half as much more than those three provinces taken together, it must be admitted that there is plenty of work for the Society to do.

With reference to the suitability of coarse Irish flax for those textile fabrics whose raw material is now furnished by Russia, little doubt can exist that, in the event of a large surplus being available for exportation from Ireland, it would be freely taken for this purpose. As the growth has increased, the export has advanced *pari passu*. Scotland is the great seat of consumption of coarse flax, and we find that country has received from Belfast alone—

In 1850 ...	...	...	...	684 tons
" 1851 ...	...	...	...	2,286 "
" 1852 ..	...	...	...	3,006 "

and although the export fell, in 1853, to 1,754 tons, this decrease may be attributed to the very great additional demand caused by 42,700 spindles being added to the Irish factories last year, which absorbed the greater part of the home-grown fibre. In the first six months of the present year, 3,199 tons of flax and tow were shipped from Irish ports to Scotland, against 1,252 tons in the same period of 1853. The export to France, also, which had no existence prior to 1849, increased as follows:—

In 1850 ...	...	...	...	107 tons
" 1851 ...	...	...	...	436 "
" 1852 ...	...	...	...	971 "

In 1853 it fell again to 353, from the cause already referred to. Shipments have also been made, during the last three years, to Belgium, Germany, and the United States of America. In fact, the Irish fibre is found to possess superior merits for spinning to Russian, and there is little doubt that it would almost entirely supplant the latter, if produced in sufficient quantity.

It is deeply to be regretted that Irish flax-growers have hitherto confined their attention to the production of fibre alone. Ireland is, among all flax-growing countries, the only one which persists in sacrificing the seed. And this is the more extraordinary, when we find that the East Indies, Turkey, Sicily, and other countries, cultivate the plant for the seed alone, the fibre being totally lost to industrial purposes. It is true, that in certain districts of Ireland the seed is saved, and that the area sown with seed of home growth is annually increasing; yet the fact is patent, that the great bulk of Irish flax is steeped without the seed being previously separated, and last year the loss by this wasteful practice cannot have been less than half a million sterling.

It is to be hoped that Irish farmers will become more alive to their true interests, and that they will ere long economize this valuable product. A pressing necessity at present exists, arising from the Russian war. Owing to the blockade in the Baltic, we cannot expect to receive the usual supply of seed for next year's sowing, and if no means be devised for meeting this emergency, the result, a very short sowing of flax, would

be most calamitous to our great staple manufacture, while it would, at the same time, deprive the flax-growers of a great source of profit in the production of an article which has reached a very high price. In addition to the value of the fibre, enhanced as it has been by the war, we may place the seed, which from the same cause is fully 40 per cent. dearer, for the manufacture of oil, than at this period of last year. Let us hope, then, that Irish farmers will be wise in time, and will provide against all emergencies by saving the seed of this year's crop, both for the next year's sowing and for conversion into oil and cake. If the Russian war should stimulate an increased sowing of flax, and should establish the saving of seed on a firm basis, the expense, as far as regards Ireland, will be amply compensated by a permanent addition to national wealth.

ART. II.—*Account of experimental Inquiries made by M. DARCY on the motion of Water through Pipes.* By HENRY HENNESSY, M.R.I.A.

A VERY elaborate series of experiments have been recently made at Paris, on the motion of water through pipes, by M. Darcy, director of the public water works of that city. A memoir detailing the methods of experiment, and the results obtained, having been submitted to the Academy of Sciences, a commission of inquiry was appointed, from which has emanated an extremely valuable report, drawn up by M. Morin, and published in the number of the *Comptes Rendus* which has been just received.

The utility of economising and properly regulating the supply of water to towns and manufactories, is now so fully recognized—the industrial and social importance of any practical conclusions that may be drawn from well-conducted hydraulic experiments, so completely admitted—that it appears desirable to give the utmost publicity to these investigations.

The experimental and mathematical researches which have hitherto formed the basis for engineering calculations, have generally afforded but little information as to the influence of the condition of the interior surfaces of the pipes on the resistance to the flow of water. Partly resulting from this cause is the fact not unfrequently observed in connection with great water works, that while the volume of water actually discharged through new cast-iron pipes is generally greater than that deduced from scientific rules, as soon as the pipes have been some time in use, and that deposits have been formed in them, the state of things is entirely reversed.

One of the chief objects of M. Darcy's investigations being to clear up practical difficulties of this kind, he proceeded to make a series of experiments, in order to determine—

1. The influences of the state of the surfaces on the discharge.
2. The influence of the diameters of the pipes on the resistance.

He used pipes varying in diameter from the smallest ever used for practical

purposes, to half a metre, or a little more than one foot seven inches and a half. The pipes were also of different materials, some of drawn iron or lead, and some of iron coated with pitch, or of smooth glass, also cast-iron pipes, some of them quite new, some old with deposits, and some old without deposits.

The experimental arrangements were such that the observer was able to measure the pressure or effectual head of water in the iron pipes at the origin of movement and at distances of 50 and 100 metres [164 and 328 feet] farther on. The differences would give the measure of the loss occasioned by the resistance of the surfaces.

The leaden pipes, which were 50 metres long, or more than twelve hundred times the diameter of the thickest employed, had the pressures measured at a distance of 25 metres. A similar arrangement was made in the glass tubes, which had nearly the same dimensions. The mean velocities obtained in these experiments varied from 0.03 metres to 5 or 6 metres per second; that is, from 1.18 inch to 16 feet 5 inches, or 19 feet 8½ inches nearly, thus going even beyond the limits used in practice. The inclinations and diameters of the several pipes were carefully measured by the most approved methods.

The most important general result deduced from these experiments is, that the nature and state of the interior of the pipes exercise a considerable influence on the discharge.

It appears, for example, that compared with the formulæ of M. Prony, iron pipes coated with pitch give discharges greater than the calculated results in the proportion of nearly 4 to 3; that glass gives similar results; but that in cast-iron pipes, whose diameter had been only very slightly diminished by deposits, the velocities, and therefore the effective discharges, were decidedly less than the theoretical indications, while after a thorough scouring a perfect agreement became manifest.

The diameters of the pipes seemed also to exercise a more decided influence on the discharge than what had been hitherto assigned to them; for with small diameters the results were less than by the formulæ, while they were greater for large diameters. This influence of the diameters was probably overlooked, as suggested by M. Darcy, from the fortuitous compensation established between the resistance in very thin but smooth pipes, and those of considerable thickness but encumbered by deposits.

From a discussion of his experimental results, it follows that the law of resistance is generally expressed by the usual formula:

$$v^2 B + v A = R I$$

R being the mean radius or hydraulic mean depth, I the inclination of the tube due to the resistance, v the velocity of efflux, and A and B constants. "But an exception to this law holds in the case of very thin tubes and low velocities, in which case the term B disappears, and the resistance is proportional to the velocity simply. As might be expected, therefore, the diameter and the substances composing the different pipes have been found to influence the values of A and B, for these have been found to differ in tubes of the same dimensions but of different

degrees of internal smoothness, and also in those which were equally smooth but with unequal radii.

In pipes containing much deposited matter, which is usual in those that have been some time in service, it appears from M. Darcy's experiments that the resistance (as admitted by several engineers) could be safely considered as simply proportional to the square of the velocity, thus simplifying practical calculations. These experiments being made with pressures so varied and so considerable, an admirable opportunity was afforded for testing the long admitted principle, that the resistance presented by the sides of a tube to the liquid passing through is independent of the pressure of that liquid. It was found, for example, that where the head of water varied in the ratio of from about 55 feet 9 inches to 85 feet 4 inches, and again from about 72 feet to 131 feet, between the two parts of the pipe submitted to observation, the differences or losses of head have remained the same for both parts. Such decisive results completely confirm the important hydraulic principle just mentioned.

In order to determine the numerical values of the constants A and B in the formula

$$v^2 B + v A = R I$$

M. Morin objects very properly to the use of the method of least squares, as not only requiring very troublesome calculations, but also introducing into the results the influence of mere accidental anomalies, which such experiments sometimes present. He prefers a graphical representation of the actual results of experiment, as being more expeditious, and capable of rendering more palpable such accidental circumstances as may deviate from the usual law. M. Darcy has employed this method simultaneously with that of least squares, and has thus in a great measure obviated the imperfections of the latter. Observers in every department of physical science might profit by the hint of M. Morin as to the successive employment of the two methods; by which, we presume, he means the application, first of the graphical method, so as to detect the accidental anomalies, and then, on their elimination, the application of the method of least squares to the purified results.

After determining the values of the constant coefficients for tubes of different materials and dimensions, M. Darcy has estimated, by the aid of his formulæ, the velocities corresponding to the different inclinations, and has compared them with the observed velocities. This comparison shows, that for all kinds of pipes, and for every diameter, as soon as the velocities attain a few décimètres,* the formula of resistance may be changed to

$$v^2 B_1 = R I$$

and this will be especially correct for pipes containing deposits; that is, for working pipes in their usual condition.

A comparison of the values obtained for the coefficient which determines the resistance in tubes differing but slightly in thickness, has shown that their different degrees of smoothness, and general condition of their

* One décimètre = 3.93708 inches, not much less than 4 inches.

internal surfaces, exercise very remarkable effects on the amount of that resistance. Thus, tubes of thin sheet-iron coated with pitch, of clean cast-iron, and of cast-iron covered with deposits, each having in inches respectively the diameters, 7·717, 7·401, and 9·567, gave for B_1 values which varied proportionally from 1 to 1·5 and 3. This result shows, that in estimating the action of a series of pipes for water works, they should be always supposed to have arrived at the normal condition of being coated with more or less deposit, no matter how comparatively smooth they may be at the time of laying them down.

Having found by experiment that the resistance diminishes with an increase of diameter, M. Darcy sought the law of variation as some simple function of the diameter, and he has shown that B_1 , in the formula last given, may be represented by two terms, one constant, and the other varying inversely with the diameter of the tube. The law thus becomes,

$$R I = v^2 \left(a + \frac{b}{R} \right)$$

Or if L represent the length of the pipe and H the height due to the resistance,

$$H = v^2 \frac{L}{R} \left(a + \frac{b}{R} \right)$$

From a series of eight experiments with tubes of drawn and cast iron, sensibly of the same degree of smoothness, and with diameters varying from half a metre down to 0m.122, M. Darcy has obtained the following numerical values:—

$$a = \cdot 0000507, \quad b = \cdot 00000647$$

When the values of R , L , and v are given in English feet—

$$a = \cdot 0000507, \quad b = \cdot 00002122$$

The expression generally recognised among hydraulic engineers as equivalent to the foregoing, is given by Mr. Neville in the form,*

$$R I = v^2 \left(a + \frac{b}{v^4} \right)$$

Where,

$$a = \cdot 00005585, \quad b = \cdot 00006659$$

On making use of these results a very satisfactory agreement was found with observation, so that it was possible to safely calculate the values of B_1 in the formula of $v^2 B_1 = R I$, for all diameters, for every centimetre from the first up to 50, or half a metre, and also for every 5 centimetres up to a metre. By simple transformations of the preceding formulæ, which will readily occur to scientific readers, it is possible to obtain rules for calculating the inclination required for obtaining a given velocity with a certain diameter of pipe, or the converse problem of finding the velocity corresponding to a given inclination.

* See Hydraulic Tables, Coefficients, and Formulæ, by John Neville, C.E. M.R.I.A., County Surveyor of Louth.

The variation of the coefficient of resistance, which must be taken into account for narrow pipes, is much less perceptible in those with diameters greater than from about 5 to 6 inches, and it may be considered, without inconvenience, as constant for all those of greater diameter.

M. Darcy has also turned his attention to another question connected with the motion of fluids in pipes, which, although comparatively unimportant for practical purposes, possesses much scientific interest. The point referred to is the law of variation of velocity of the particles of fluid from the axis of a pipe where it is a maximum, to the surface where it is a minimum. With the aid of a small and very slender *Pitot* tube, of which one branch could be placed parallel to the axis of the pipe at different distances from that axis, and of a manometer giving the pressure exercised on the surface, he has determined the excess of pressure observed at the *Pitot* tube over that on the manometer, and by a special process, the velocity of the fluid acting on this tube, or some quantity proportional to the velocity. Comparing in this way, for different inclinations, the excess of velocities in the axis over the velocities at different distances therefrom with the square roots of the inclinations, it followed:

1. That the ratio of this excess to the inclinations was constant.

2. That the ratio of this excess to the $\frac{3}{2}$ power of the distance of a moving particle from the axis was constant for the same inclination.

3. That the ratio K of the same excess to the product $r^{\frac{3}{2}}\sqrt{I}$, constant for the same pipe, varies from one pipe to another inversely as the radius, so that $\frac{K}{R}$ is constant.

It is hence easy to infer that the relation between the velocity, V , of the particles situated in the axis of a pipe, with the velocity, v , of those situated at a distance, r , from the axis, is represented by

$$V - v = \frac{K r^{\frac{3}{2}} \sqrt{I}}{R}$$

Whence, if w represent the velocity of a particle at the surface of the pipe,

$$w = V - K \sqrt{R I}, \quad \text{or,} \quad K \sqrt{I} = \frac{V - w}{\sqrt{R}}$$

Whence substituting, we obtain,

$$v = V - (V - w) \frac{r}{R} \sqrt{\frac{r}{R}} *$$

From which the velocity of any particle may be obtained if the velocities in the axis and at the surface are known.

* A slight misprint occurs in the formula given by M. Morin, *Comptes Rendus* 26th June, p. 1119, line 4, for $R^{\frac{3}{2}}$ read $R^{\frac{2}{3}}$. I take the opportunity of correcting a misprint inserted in my paper in No. V. of this Journal: at page 130, line 4, for i , read $2i$.

It finally appears that for the mean velocity, u , M. Darcy has deduced the expression,

$$u = \frac{3v + 4w}{7}$$

By comparing the results of experiments made with different pipes, M. Darcy has been led to conclude, that although the degree of smoothness of the interior of a pipe must influence the resistance, and consequently the mean velocity of the fluid, it does not affect the law of variation of velocities from the axis to the surface, which appears to depend on the viscosity or molecular condition of the liquid.

It seems that the conclusions at which M. Darcy has arrived relative to the coefficient of contraction have not been considered quite satisfactory. It appears from the theory established by M. Poncelet, that the coefficient in question is a function of that at the opening of the tube, which varies with the head of water, the dimensions of the orifices, and the velocity. It follows, therefore, that the coefficient of contraction at the origin of the pipes ought itself to vary with these quantities; but M. Darcy has obtained a constant coefficient, such as is generally admitted, and this only by a compensation of differences. We have very little doubt that a more correct result would have been obtained if he had employed in the discussion of his experiments the graphical method in the peculiar way to which attention has been already directed.

Here we must conclude our account of these important researches, which we are glad to learn will be published in detail by the Academy of Sciences, in the *Mémoires des Savants Etrangers*.

ART. III.—On the Electro-chemical Treatment of the Ores of Silver, Lead, and Copper. By M. BECQUEREL.

At one of the recent sittings of the Academy of Sciences, M. Becquerel presented a large volume, containing the results of the experiments with which he has been occupied since 1834, upon the electro-chemical treatment of the ores of silver, lead, and copper. As these experiments are of the utmost importance in connection with metallurgic industry, especially in countries where fuel is scarce or dear, we hasten to lay before our readers the substance of the analysis of this important work, which M. Becquerel himself communicated to the Academy, and which has been published in the *Comptes Rendus* for June the 26th.

We have no information on the treatment of the precious metals among the Aztecs before the conquest; we only know, from the letters of Ferdinand Cortez, that they possessed considerable quantities of gold and of silver. It is probable that this people, like those of antiquity, confined themselves to the washing of auriferous and argentiferous sands, and to

the melting of the minerals which existed in a sufficient state of purity to immediately yield gold and silver. But in 1557, Bartholomew Médina having discovered the method of amalgamation with mercury in the cold, effected a revolution in the metallurgy of silver, a mode of treatment which, as is well known, was a source of riches to Spain during several centuries. The amalgamation process, with some modifications resulting from the difference of composition of the minerals, was not completely adopted in Europe until more than two centuries afterwards; the cause is simple: the abundance of wood did not make the necessity of having recourse to mercury felt, smelting, when it is possible, being always the most expeditious way of treating ores; but on the vast plateau of Mexico, where fuel is extremely scarce, smelting could only be exceptional, hence the amalgamation process there received its greatest extension.

About twenty years ago M. Becquerel commenced a series of researches upon a mode of treatment different from the two preceding ones, and capable of being also applied to ores of lead and copper. This method, based upon the chemical action of electricity, enables mercury, and, in certain cases, even fuel, to be dispensed with. The experiments were made on more than 10,000 kilogrammes (about 10 tons) of ore from different parts of the world, and particularly from Mexico, Peru, Columbia, and the Altai mountains; they were directed particularly to—

1. The preparation to which ores should be submitted in order to transform the metals which they contain into compounds soluble in salt water at a maximum degree of saturation.

2. The decomposition of the metallic salts in solution, and the separation of the metals, the one from the other, by means of the chemical action of electricity.

3. A great number of questions connected with electro-chemistry, and the metallurgy of silver and lead in particular.

The following are the divisions of the work:—

CHAP. I.—An exposition of the principles of electro-chemistry to serve as the basis of the treatment of ores.

CHAP. II.—Preparation which the ores to be electro-chemically treated should undergo.

CHAP. III.—Method of treating the ores of silver by the wet way, including the American process of amalgamation *au patio*, the amalgamation process of Freiberg, and the amalgamation *au cazo* or by boiling; exposition of the electro-chemical treatment of ores and of the questions connected therewith.

CHAP. IV.—Description of an electro-chemical works established on an experimental basis, to operate upon 1,000 kilogrammes (about 1 ton) of mineral at a time.

CHAP. V.—Statement of the results obtained by the electro-chemical treatment, and by the amalgamation *au cazo*, of the ordinary ores of Mexico—blende's, gray copper, and argentiferous galena.

The electro-chemical treatment consists, as has been said, in the preparation of the ores in such a manner that the compounds of silver and of lead, which result when galena is operated upon, would be soluble in a solution

of common salt at its maximum point of saturation; these compounds are the chloride of silver and the sulphate of lead. The solution once made, is run into reservoirs of wood as soon as it has become clear; there the decomposition of the metallic salts is effected with Voltaic couples formed of plates of zinc and of tin-plate, or of copper, or of masses of well calcined charcoal, or also with couples composed of plates of lead and the same electro-negative elements. The plates of zinc or of lead are placed in sail-cloth bags filled with a saturated solution of common salt, and immersed in the saline solution of the metals dissolved out of the ores, the electro-negative plates being immersed in the latter solution; communication between both is then effected by means of metallic slips. With zinc electro-positive plates an electro-chemical deposit is obtained upon the electro-negative plates, consisting of all the easily reducible metals—silver, copper, and lead—in a very minute state of division; with lead electro-positive plates, the deposit consists of silver more or less pure according to the proportions of lead which happen to be in saturation.

Instead of sail-cloth sacks it would be better to employ boxes of wood, some millimetres* in thickness, previously exposed to the action of steam in order to remove all soluble extractive matter; or cells of semi-baked clay, filled as far as possible with fragments of amalgamated zinc and mercury. The action is in this case more regular, and the quantity of zinc consumed is in atomic proportion with that of the metals deposited.

By varying the composition of the voltaic couples we may successively separate each of the metals in solution in the salt water.

The experiments, the results of which are given in the work of M. Becquerel, were made on quantities of ores varying from 100 grammes (1,543·4 grains) to 1,000 kilogrammes (2,204·85 lbs., or something less than one ton); and the quantities of silver collected in the space of 24 hours have varied from a few decigrammes† to 1 or 2 kilogrammes,‡ so that it was possible to appreciate the advantages and the inconveniences of the electro-chemical treatment of the ores of silver, lead, and copper, particularly of the two first, the preparation of which presents more difficulties than the latter.

From what has been just stated, it would appear that the electro-chemical treatment of the ores would be terminated in 24 hours; but in operating with the powerful assistance of an independent pair, the temperature of which would be elevated by means of steam, it could be effected in 18 hours. It is, of course, to be understood that this couple is voltaically connected with the other apparatus; in operating thus, only plates of lead are placed in the latter, of which some act as the electro-positive elements of the circuit, and the others the electro-negative; and although lead acts directly upon the chloride of silver in decomposing it, the two currents in opposite directions, which result from this action, do not appear to injure the effect of the independent couple. In this manner the advantages resulting from the immediate precipitation of the silver by the lead may be

* One millimeter = 0·03937 of an inch. † One decigramme = 1,543 grains.

‡ One kilogramme = 2·2048 lbs.

combined with those resulting from the electro-chemical action of the independent couple, which transforms each apparatus, at the ordinary temperature, into a voltaic couple.

After several operations, in which plates of lead are employed, the salt water will be found to contain only chloride and sulphate of lead, which is to be decomposed by means of lime.

As it would be impossible to indicate here all the precautions to be taken in submitting the different kinds of silver and lead ores to the new process of treatment, we shall only add, that the ores the most refractory in amalgamation, and the most difficult in the smelting, such as blende ores and gray copper, may be treated with facility by this process.

Argentiferous galenas when the lead is converted into sulphate, and the silver into chloride, may be rapidly treated by the process of amalgamation *au cazo*, without further loss of mercury than that inevitably produced by the washing of the ore to obtain the amalgamation. M. Becquerel points out the means of thus reducing the loss of mercury. Metallurgists, he believes, will appreciate the mode of treating galena, which admits of immediately extracting the silver without cupellation, when the ore has been roasted under certain conditions, and of then obtaining the lead by electro-chemical means, and containing only insignificant traces of silver. The lead deposited on the electro-negative plates is in a fine state of division, or in the condition of a sponge; when washed, and while still moist, pressed, it is melted in clay crucibles, the surface being covered with charcoal dust to prevent oxidation. Several hundred kilogrammes of lead have been thus melted. The precipitated lead is pyrophorous, and hence it should not be allowed to dry in the air, otherwise it would oxidize with evolution of heat. In this condition it is peculiarly adapted for the manufacture of white lead.

M. Becquerel did not consider it sufficient to merely make his experiments on a large scale; it was also necessary that they should be repeated and judged by a skilful practitioner; this has been done by M. Duport Sainte-Clair, formerly silver refiner in Mexico, who has communicated the result of his experiments and of his observations in his work entitled "*Sur la Production des Métaux Précieux au Mexique.*" At page 405 of that work the author thus speaks of the electro-treatment of silver ores:—

"If by one of those eventualities not very probable, but possible, the mine of Almaden ceased to furnish cinnabar, either by a falling in, or from the flowing in of too much water, or finally, from the whole of the ore sufficiently rich in mercury having been extracted, the production of quicksilver, thus reduced to that of the mines of Carniola, would be very inadequate to supply our wants; such an increase of price would take place as would be equivalent in some sort to an absolute deficiency of the article. What would then become of the extraction of silver in Mexico? A few years ago the solution of this question would have been very embarrassing, for no other mode of extracting silver from its ores was known, except that by smelting or by amalgamation. The learned researches to which M. Becquerel has devoted himself, with all that perseverance which the first application of science to industry always demands, have contributed to metallurgy a means perfectly new, in the employment of electric forces. Initiated by the inventor himself in all the details of this new process, I have been able to convince myself of the possibility of its industrial application to the ores of Mexico, as well

by the experiments made upon 4,000 kilogrammes (nearly 4 tons) of the ores of the principal districts which I had got brought to Paris about three years ago, as by those which I repeated myself at the localities. The possibility of its application on the great scale once established, the question reduces itself to a comparison of numbers between the cost of the old processes and the new one; and the first researches which I made in metallurgy had in principle no other motives. . . .

. . . The results of my researches were favourable to the electro-chemical process for a great number of ores, I do not say alone upon the not very probable hypothesis of an absolute deficiency of mercury occurring, but even with the present high price of that metal. On this account we have a right to be astonished that the process has not begun to be employed; the causes which have prevented this taking place, having general characteristics of sufficient importance in reference to the establishment of every new process, I shall enter, upon this occasion, into some details upon the subject. The simplicity of the apparatus required for the Mexican amalgamation process is itself a considerable obstacle to any innovation; then comes the force of habit in an art practised during three centuries, and one, too, well understood in an economical point of view; and finally, the necessity of operating on considerable masses in order to acquire faith in the process, whilst at the very outset an outlay must be made, so much the more costly that every construction for industrial purposes is very dear in Mexico, must succeed in at length damping the zeal of innovators.

"Mercury being the principal chemical agent employed in the present mode of working, its price is of great importance in comparing the processes in use with those which it is wished to substitute for them, since, whether but little mercury be employed, or none at all, there is an evident tendency to diminish the demand for that metal, and on this account to lower its price.

"The chance of a fall in the price of an article, where that price depends, as is very generally the case, upon its cost of production, would offer but slight probability of any considerable variation; but in the case of mercury it is quite different, for in consequence of the monopoly, its actual price may be considered to be four times its cost of production, and in proportion as its employment becomes less, the price may lower almost suddenly, in a manner disastrous for those establishments employing some new process destined to replace the mercury, or diminish its loss in amalgamation."

M. Duport again remarks, and this consideration is important, that independently of the circumstances relative to mercury, we must also take into account those having reference to the employment of common salt, the basis of M. Becquerel's process, and the loss of which could not be neglected, except where the price of this substance would be low; but this is not the case in the greater part of the mines of Mexico, where the price often exceeds forty francs the metrical quintal.* If these difficulties be obviated, nothing further can oppose the employment of the electro-chemical process. From this it may be concluded, that in all the mining regions where the common salt is cheap, the electro-chemical process is applicable, provided always that, when the silver ores are the complex sulphurets, there be sufficient fuel in the district for roasting them. For example, the ore of Sainte-Marie aux Mines, in the department of the Haut Rhin, situated in the neighbourhood of large salt works, which present difficulties in their treatment by the methods now in use, may be easily worked by the new process.

However great may be the immediate value of these researches of M. Becquerel as applied to Mexican mining, they are scarcely less important

* 16s. 3d. per cwt.

when viewed in reference to the future progress of metallurgy generally; for they open up a new and untrodden field, the cultivation of which appears destined to completely revolutionize that branch of industry. Should these predictions be verified, the manufacture of metals may one day be freed from the slavery of fuel, and nations whose mineral wealth is now of little consequence from the want of that element may arrive at the first rank in the production of metals.

ART. IV.—*On the Application of the Centrifugal Blowing Machine to High Furnaces.* By FREDERICK MARQUARDT.

[BESIDES its great immediate importance to British and Irish iron-masters and founders generally, the following paper may possess special interest in Ireland, in connection with the attempts which are now about being made to puddle iron by means of gas produced from turf, as is practised in Germany, and upon which we shall have much to say in a future number. It may also be deserving of attention in connection with the process of Reece, for obtaining the products of distillation from peat, should that process be found as successful as is anticipated. Any experiments or improvements connected with blowing machines are the more important from the little which has been recently done to improve the present generally clumsy and imperfect machines.]

An attempt has been made to apply the centrifugal blowing machine for smelting purposes in the high-furnaces of the *Nexahütte* in Szaska, in the Banat, near the Turkish frontier of Austria. The object of this paper is to record the results of the trials made, and to describe the construction of the apparatus.

The high-furnace here referred to has a diameter of 7 feet at the boshes, and is 33 feet high from the hearthstone to the tunnel-head. The hearth is $18\frac{1}{2}$ inches at the bottom, and 29 inches at top; the crucible is $18\frac{1}{2}$ inches to the tuyere's, and the whole height of the hearth 5 feet $8\frac{1}{2}$ inches.*

The ores employed for smelting consist of compact magnetic ironstone, yielding 70 per cent. of raw iron; red and brown hematite, averaging 55 per cent., and earthy iron ochre, and yellow hematite, averaging 30 per cent., and finally, ankerite, yielding 22 per cent. Some of these ores are extremely fusible, but difficult of reduction, and among them, the magnetic ores especially, are so dense and compact that they cannot be completely reduced without repeated roastings.

The fuel generally used consists of hard beech charcoal, of which the

* All the measurements given in this paper, when not otherwise expressed, are English.

Austrian cubic foot [1.112 English cubic foot] weighs 12 Austrian pounds [14.8 English pounds]; to this was added, with very satisfactory results, about one-third of ordinary pit coal, of which 13 pounds is equivalent to one cubic foot of charcoal.

The two centrifugal blowing fans (one for present use, the other being kept in reserve) have each a diameter of $20\frac{3}{4}$ inches, the vanes are $6\frac{3}{4}$ inches long; those of one fan being $3\frac{3}{8}$ inches wide, and those of the other $4\frac{3}{8}$ inches. The wind openings are $9\frac{1}{2}$ inches in diameter, and placed somewhat eccentrically in the fan case. The axle is of cast steel, with a maximum diameter in the middle of $3\frac{1}{10}$ inches, the journals being only 13 lines. These are tempered to the hardness of glass, and finely polished. The gudgeons consist each of a single piece, carefully and exactly drilled, and composed of an alloy of 84 parts of copper to 16 of tin.

An exact and careful setting of the axle in its bearings is absolutely essential, and upon it chiefly depends the durability and effective working of the

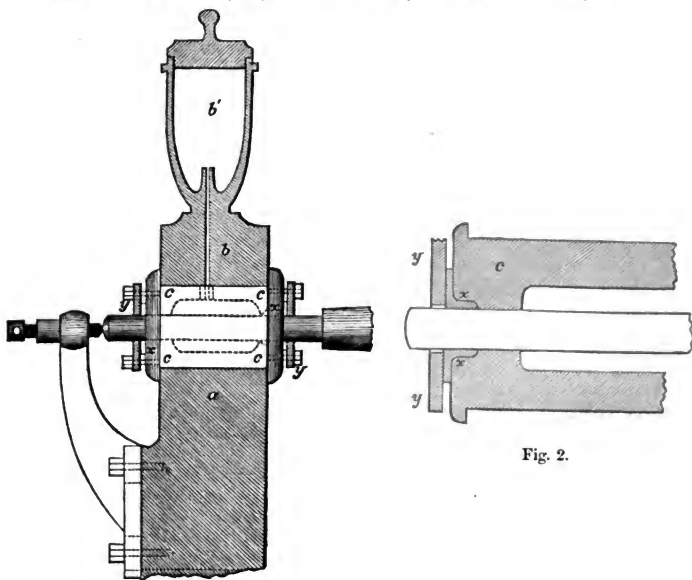


Fig. 2.

Fig. 1.

entire apparatus. In figures 1 and 2, *a* is the lower side of the pillow-block, *b* the cover or bonnet with the oil-box, *b'* opening into it, and *c* the metal axle cushion. The journals lie on the latter only at both ends, so that a

small space being left in the middle for the oil, the journals are to a certain extent surrounded by a layer of oil. To prevent the oil from running off there are leather flaps *x*, which are wedged into the gudgeon lining *c* by the piece *y*, and embrace lightly but firmly each of the journals. This simple contrivance prevents waste of oil, causes the journals to be always surmounted with the liquid, and prevents them from becoming heated.

From figure 2 it may be seen, that the journals do not lie clumsily in their gudgeons, but perfectly smooth and true. On the other hand they have spherically rounded ends, and turn with these between two similar spherically-ended adjusting steel screws, which prevent any side movement in the direction of the axis. When these screws are brought to bear exactly against the centres of the pivots, but yet leaving a scarcely perceptible space, if the axis of the journals coincides with that of the axle cushions, it is certain that many months may elapse before the slightest attention will be required to this portion of the apparatus, and that the journals will never become heated, no matter how quick the fan may be driven.

A very important portion of the centrifugal blast machine is its system of vanes. These vanes should be capable of catching, in a continuous manner, the surrounding air, and then of pouring it towards the furnace with the velocity of its centrifugal motion. The vanes must therefore commence at the axle itself, with a regular curvature, and be very firmly and solidly fixed, so as to be free from shock or vibration, and finally, they should be so exactly alike in size and weight, that when arranged upon the axle with the journals placed horizontally, they should exactly balance each other in every position. The least imperfection in this respect, in consequence of the great velocity of rotation of the fan, would exercise a fatal effect upon the entire arrangement, and in a short time derange its stability.

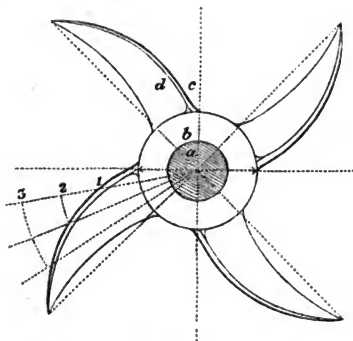


Fig. 3.

R

In the arrangement here described, the vane stock *b*, fig. 3, with the four vanes, is cast out of malleable gun metal. The vanes are curved on the axis *a* towards the edges and circumference, and their surfaces are adjusted at right angles to the direction of motion. The vanes have at the shaft a thickness of six lines, at the circumference a thickness of three lines, and are strengthened in the middle by ribs six lines thick. The figure shows the amount of curvature.

During the first trials the vanes were made much weaker, and a change in their dimensions was soon desirable. Several vanes were literally torn asunder by the centrifugal force, and their fragments flung far into the blast pipes. Several different forms of vanes were also selected, straight and radiating, straight and not radiating, but deviating in the direction of the motion, and also deviating in the opposite direction, some divided by a disk in the middle. Among all of them, that which is here delineated was found most advantageous, and while the sound it makes is so slight as to be scarcely heard outside the works, others produced such a tremendously ear-splitting roar, that they could be heard, even by day, miles off, in the valley of the Nexa, and along the mountains.

When I add that the fan is fixed on a heavy iron plate and arranged with a surrounding tin pan to collect any waste oil, and that the whole rests on a framework of strong and heavy beams, I trust its construction has been made sufficiently plain.

The centrifugal machine here described is driven by one of Fontaine's turbines, which works with a clear fall of $7\frac{3}{4}$ feet. A turbine must necessarily be selected under the circumstances, for the water comes directly out of a mountain stream, the Nexa, and flows back again after performing its duty; during floods the upper and lower waters rise several fathoms, and at such times any other hydraulic machine would be evidently unsuitable. The turbine makes 60 revolutions in a minute at its maximum speed, and transfers its action by two successive series of belts and multiplying wheels in a fifty-fold proportion of speed to the centrifugal machine. The fan consequently makes 3,000 revolutions per minute, which gives, at the circumference of its vanes, a velocity of 259 feet per second. The observed pressure on a sensitive water manometer placed in the blast pipes, is a fraction of this velocity, and agrees exactly with calculation.

With the aid of these apparatus and mechanical contrivances, I have been able to collect a mass of experimental facts and observations, of which I beg to submit the principal conclusions. These are given, first, in so far as they refer to the actual arrangements of the blowing machine, and then as to its special application to high-furnaces. The following are the principal results alluded to:—

1. The area of the orifice of the tuyere ought at most not to exceed half the surface of a vane.

2. In this case the air will rush out of the tuyere with nearly the circumferential velocity of the vanes, and the pressure shown by the manometer will be a fraction of that velocity.

3. If this maximum area be diminished, so may also the requisite driving power, while the original velocity may continue to be maintained. By

uniformly continued driving force the velocity of the vanes becomes continually accelerated, and the pressure exhibited by the manometer continues still a function of the increased velocity. If the area of the orifice should be reduced to zero, the resistances to the impelling force will be reduced to the friction of the machinery, and that of the air passing between the vanes and their framing.

4. If the orifice of the tuyere is greater than the above mentioned maximum, the velocity of the blast will be proportioned to that of the circumference of the fan in relation to their surfaces. Consequently, in order that a centrifugal blowing machine can perform the greatest effect with the smallest driving force, the area of the orifices of the tuyeres must be to that of one of the vanes in the proportion of 0.9 to 2. Moreover, the maximum quantity of air which can be blown by a machine of given dimensions is very approximately deduced from the product of half the area of a vane, by the circumferential velocity.

The effective mechanical work of a blowing machine can be obtained only from a comparison of its maximum duty with the driving force required for that effect; and the effective mechanical work done appears, from experiment, to amount to 92 per cent. of the maximum duty.

Finally, with a given determinate quantity of air to be blown out from a machine, the surfaces of the vanes must be less in a certain proportion, according as the velocity with which the air is to be blown increases.

If this rule be applied to existing fan blowing machines, it follows that almost all such machines (at least so far as I have seen) have entirely too large dimensions, that they are too weak for high pressures of wind, and lastly, when driven at the maximum of their blowing power, they would require a driving force far exceeding their power of endurance.

Such fans as are usually in connexion with cupola furnaces, mechanical workshops, &c., have generally vanes of from 103 to 107.3 square inches; these fans would be able, with a circumferential velocity of 259 feet per second, to deliver at the blast orifice the enormous volume of 5,103 cubic feet of air per minute; in other words, enough to supply three great charcoal high-furnaces, or five cupola-furnaces, with sufficient wind.

There the continuous working of such blast machines during fifteen months' experience, has fully established the fact, that with charcoal high-furnaces the requisite strength of wind can be obtained. Without working the machines so as to rapidly wear them out, or to exercise a disturbing action on their parts, they maintained daily for several months a velocity of 4,000 revolutions per minute; in other words, a velocity of 342 feet per second at the circumference of each fan; and this took place without heating of the journals, nor any perceptible wear and tear, except in the belts of the multiplying wheels, which could not completely resist the effects of such a high working speed. All remedies appeared useless in this case, and even belts cut from the best American hides were insufficient, and became rapidly warped and cracked along their fibres.

The attempts made to discover the causes of this phenomenon, unquestionably showed that there was no slipping of the straps on their pulleys, and consequently that no perceptible heating of the leather could

result. It appears further, that the rapid wear of the belt, which embraces the comparatively small disk on the axle of the fan, indicated that the continued bending of the strap fibres around a pulley of such small diameter, caused the fibres of the leather to be cracked, and their internal organization to be broken up. The continually recurring essential repairs of the belts are the only considerable impediments which interfere with the regular working of the centrifugal blowing machines at high velocities.*

The high furnaces of the Nexa works, where the kind of blowing machines here described are in action, require about 1,109 cubic feet of air per minute. Unquestionable experiments have proved that the processes of reduction and fusion, as also the production of a good gray pig iron, suitable for castings, are effected as rapidly and as advantageously with a blast of low pressures as with those of high, provided only that the necessary quantity be introduced into the furnace. We have worked as well with a pressure equal to four lines of mercury, and with the same consumption of charcoal, as with twenty-four lines, and have obtained in the one case as in the other, under otherwise similar conditions, good products. The pig iron was of exactly similar characters in both cases.

Notwithstanding such results, the overseers of the works have not shown themselves altogether favourable to the centrifugal system of blast, and endeavour, as far as possible, to attribute to the system itself whatever disadvantage may result from their usual defects of workmanship, or from any casual occurrences that may exercise a disturbing action on the machinery. I have often remarked the stubborn prejudices exhibited against the system, by otherwise able and enlightened overseers, and which for the most part arose from their ignorance of the dynamical arrangements of the mechanism. I have even heard it maintained that no pressure of blast could be produced in the blast pipes, as the compressed air must naturally rush back through the open case. But in spite of all this, I am convinced that no other blowing machine, whether considered in relation to the expenditure of power required to work it, or to its working effect, surpasses the centrifugal blowing machine; and that as soon as the present system of driving bands and multiplying wheels can be replaced by another more durable system of gearing, this blowing machine will be found the simplest and best for charcoal high furnaces. For this purpose its moderate first cost, trifling working expenses, great effective power, and the production of a blast of unsurpassable and perfect uniformity.—*Polytechnisches Journal. Bd. cxxxii. Heft, 2. p. 81.*

[We would recommend a trial of such a blowing machine, with the addition of Minotto's system of wedge wheel gearing for communicating the motion, to some iron masters, even in the case of coke high furnaces. Of its general applicability in all ordinary foundries, instead of the present imperfect fan, there appears to be no doubt, and we hope therefore to hear of its being soon tested.—Ed.]

* This seems to be a case where the wedge and grooved wheel system of gearing proposed by M. Minotto, and described in No. V. of this Journal, p. 129, could be applied with great advantage.—Ed.

ART. V.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

MINING, METALLURGY, ETC.

Woelckner's Improvements in the Pistons of Horizontal Cylinder Blowing Machines.—The structure of the piston in this description of blowing machine appears to exercise an important influence on the efficiency of the apparatus, from the unequal wear of its different parts, and the vibrations and shocks to which they are exposed. M. Woelckner, in his capacity of director of the workshops at Petersdorf, in Moravia, had also opportunities of observing the injurious effects of the method of lubrication employed for these pistons: the graphite employed for that purpose, disengaging itself gradually from the piston, and accumulating at the back of the cylinder, where it formed masses that gave rise to shocks, and even breakage of the machinery. To put an end to these disadvantages, he devised a new arrangement, which he applied to a large blowing machine, with cylinders 5 feet 5½ inches in diameter, worked by an engine of 50 horse power.

The piston consisted, as usual, of two plates, having intermediate elastic bands, over which he proposed to obtain control by an arrangement of screws, which would permit him to make the piston more or less tight. Instead of surrounding the elastic portion of the piston with leather bands, he substituted some folds of thick linen, prepared in the following manner:—It was first stretched on a table, and strongly impregnated at each side with a mixture of graphite, reduced to impalpable powder, and very clear glue, until a pretty thick coating was fixed on the linen. The prepared linen was then cut on patterns, in the form of ring shaped segments, about 2 feet broad, and these were then packed and overlaid on the piston, so that the joinings of each layer were completely covered by the next, and before placing any segment, it was carefully rubbed with powdered talc. The covering of the elastic band was raised by a little more than an inch above what it would be after being compressed by the screws and plates, and after this, all inequalities on the surface were carefully removed by a file. After the piston stuffing had worked for some time, the inside of the blowing cylinder presented a brilliant dark polish, and the appearance of the band around the piston was like polished cast iron.

On the permanent Expansion of Cast Iron by successive heatings.—In the memoirs of the Industrial Society of Hanover for last year, there are some interesting remarks on this question. The remarkable phenomenon that cast iron presents on being heated, of not returning back to its original volume, but of continually shewing an increase of that volume, and of permanently acquiring an enlarged volume by successive heatings and coolings, had been first observed by Rinsep, in 1829. That chemist found that a cast iron retort, whose capacity was exactly measured by the quantity of mercury which it could contain, held at first, 9·13 cubic inches; after the first heating and cooling, 9·64 inches; and after three heatings, up to the melting point of silver, 10·16 cubic inches. The cubical expansion ought, therefore, to be 11·28 per cent., which gives 3·76 per cent. nearly of linear expansion.

At subsequent periods different phenomena were observed, more or less confirmatory of this law. The cast iron bars of grates, where powerful fires were made, were frequently observed to elongate, so as to become jammed tight in their frames, and when these obstructed all further enlargement, the bars became curved or twisted. M. Brix, in his work on the calorific power of the fuels of Prussia, has detailed a few experiments on this subject. By the aid of several measurements, he has shewn that the entire permanent elongation increases after each successive heating, but that the amount produced by each heating diminishes the more frequently the bar is heated, until it finally becomes insensible. Thus, a furnace bar 3½ feet long, after being three days exposed to a moderate fire, had already acquired a permanent elongation of $\frac{1}{4}$ of an inch, or 446 per cent., at the end of seventeen days, 1·042 per cent.; and after thirty days, 2 per cent., but

had not yet reached its maximum. Another bar of the same kind, after a long service, had a permanent elongation of 3 per cent.

If it be remembered, that bars while exposed to the fire undergo another temporary elongation; we must agree with M. Brix, that an allowance should be made in a bar which has not as yet been used, amounting to 4 per cent. of its length, for this cause of elongation. The bars must, of course, be sufficiently long to stand between their supports when cool, but it seems that hitherto sufficient room has not been given for this permanent expansion in laying down new bars.

On the Fatigue and consequent Fracture of Metals.—At a meeting of the Institute of Civil Engineers of London, Mr. F. Braithwaite communicated a paper, in which he points out the different consequences that will result to masses of metal, according as they are obliged to bear a continuous strain, or one repeated at intervals. In the latter case a certain disturbance of the particles takes place, the metal becomes sooner deteriorated, and ultimately breaks from the action of the reiterated strain. He contends that, presuming adequate dimensions to have been given to girders, and the stipulated weight not to have been exceeded, there is not much chance of accident; but any repeated deflection must be productive of danger, which can be averted only by altering or replacing the parts deficient in strength, and maintaining a rigid supervision, whether of beams loaded, of machinery, or of the rolling stock on railways.—*Artizan for July.*

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

On Bourdon's spring Manometers.—Although the oscillations of a mercurial column furnish perhaps the best means for measuring moderate changes of pressure in elastic fluids, it has been long a desideratum to obtain something better suited to the measurement of very high pressures. This seems to be the most important advantage claimed for the inventions of M. Bourdon, of which we propose to treat in this present notice.

The principle upon which these manometers is founded is the variation of curvature which must take place in a tube of elastic metal, shaped like an incomplete ring, with a flattened cross section, from changes in the relation between the internal and external pressure on its sides.

It is found by experiment that when such a tube is placed in a medium which exercises a constant pressure, if it be filled with fluid, so as to increase the pressure within it, the curvature lessens as it distends, and the ends of the incomplete ring diverge. When the pressure of the internal fluid is less than that of the surrounding medium the curvature increases, and the ends of the incomplete ring are found to approach. Conversely, if the internal pressure were constant, an increased pressure of the external medium will cause an increase of curvature, and a diminished pressure a diminution of the curvature of the imperfect ring. If a perfect vacuum were formed in such a tube hermetically sealed, the internal pressure would be zero and constant, while the external pressure would depend on the conditions of the surrounding medium. Such a tube placed in the air would thus constitute a barometer.

It is easy to explain how the distension and contraction of the sides of the tube can produce the changes of curvature in tubes of a circular form.

Let a represent the angle subtended by an arc of a circle, whose length is L , with the radius R ; then as the angle at the centre of a circle is directly as the length of the arc which it subtends, and inversely as the radius—

$$a = \frac{L}{R} = \frac{l}{r}$$

l being the length corresponding to the radius r . If we suppose a section made in the plane of the ring, R may represent the radius of the outer circle bounding that section, and r the radius of the inner and smaller circle. Let d represent the interval between the two circles. Then,

$$d = R - r = \frac{L - l}{a}$$

Let d' represent what d becomes by a dilation or contraction of the sides of the

tube, the lengths of the arcs remaining constant, a changes to a' , and therefore, $d' = \frac{L-l}{a'}$. Finally, we have $\frac{d}{d'} = \frac{a'}{a}$. Consequently the angle at the centre will be inversely as the distances of the flattened sides of the tube, and therefore the curvature of the ring will also be inversely as these distances. If the inner and outer parallel edges of the section of the ring are not circles, we may suppose them made up of a series of circular arcs, each arc having for its radius the radius of curvature at that point. The above result will manifestly hold good for every corresponding pair of these arcs in the two curves, and consequently the approach or separation of the two curves will be followed by an increase or diminution of the curvature of the ring.

In order that such a tube could be applicable to the measurement of pressures it should follow that its changes of curvature would be proportional to the changes of external or internal pressure. In other words, the resistance of the tube to changes of flexure should not be variable. Let the opposite flattened sides of the tube be decomposed into a series of bands or filaments, each of these will undergo similar changes of flexure with the same pressures as straight bands of the same dimensions. But the flexure of such a band is measured by the versed sine of the arc which it forms under pressure, and is proportional to the intensity of that pressure—a result completely verified in the case of ordinary springs consisting of solid slips of metal, and which appears very approximately true in the case of hollow slips of metal such as the tubes in question. In point of fact, these might with great propriety be called hollow springs, and the instruments of which they form the base, spring manometers.

It is easy to conceive how the movements of these hollow springs can be measured by a suitable graduation. It only requires to have this graduation made by a comparison with mercurial column manometers, in order that the instruments would be independent of variations in the proportionality of the flexures of the tubes to the pressures, and such a course seems to have been hitherto very successfully adopted. The graduation has usually been on a circular arc of more or less dimensions, the movements of the ends of the hollow spring being transmitted by lever-work to a traversing needle.

An objection to these instruments seems to arise from the possible changes in the elasticity of the substance composing the tubes, whereby the indications of the needle would ultimately be rendered utterly valueless. But it is stated that hitherto, even at the extreme limits of their indications, no perceptible alteration has taken place in the accuracy of the instruments, and it seems extremely probable that one of them would continue to give correct results as long as the elasticity of the hollow springs is not too severely tried.

The invention was first suggested to M. Bourdon by an accidental observation. In January, 1849, he was constructing some machinery, to which he had to connect a worm-shaped tube. This tube having been bulged through some mismanagement, he was obliged, before using it, to stop it at one end, and to force water in at the other by means of a hydraulic press, until the pressure, overcoming the resistance of the metal, would smoothen out the creases and bulgings, so as to bring it back to its proper shape.

During the injection of the water, a very decided bending of the entire tube was observed, according as the parts which had been bulged commenced to swell out from the pressure. M. Bourdon immediately saw the value of this phenomenon with reference to the measurement of the pressure of elastic fluids, such as steam and the gases, and after a series of trials, was at length enabled to present his manometer at the Paris Exhibition of 1849, where he received the Gold Medal. At the Exhibition of All Nations in London, he obtained a Council Medal; and in the Reports of Juries, p. 201, is a short but favourable notice of his inventions.

The inventor proposes to apply these hollow springs to different kinds of manometers, applicable to different purposes. Among these are what he calls *maxima* and *minima* manometers, which, in the case of steam engines, and especially locomotives, will be doubtless found more suitable than instruments depending on the mercurial column. He also proposes to construct manometers for the hydraulic press, and is said to be actually constructing one for a carbonic acid solidifying apparatus, that will indicate the pressure of 300 atmospheres.

It is easy to conceive, after what has been stated, how barometers can be constructed on these principles. Those which have been actually made very closely resemble the Aneroid barometer in outward appearance, though the internal arrangements are in many respects essentially different.

The American Tunneling Machine.—Talbot's "tunnelling machine" has been tried with complete success; and it has been demonstrated that mountains of primitive stone and the hardest rocks in the earth can be successfully and economically tunneled by the agency of steam applied to this new invention. The slow and expensive process of perforating by the drill and blast will be thrown aside. In the trial experiments, the machine moved by a steam engine, cut an excavation of 17 feet in diameter through the hardest rock, at the rate of about 3 feet in two hours. The process consists in cutting and crushing the rock by means of rotating discs of steel, in successive series, which describe in their movements segments of circles from the centre to the circumference of the tunnel, with a gradual motion around the common centre; while the steam-engine is constantly pressing the machinery on a direct line with the axis of the tunnel. The newest and most extraordinary feature of the application of this power, consists in the combination of different sets of discs, which act upon the entire surface, to be excavated by a system of gradation perfectly regular, and by a power that is irresistible. The machine, which worked most satisfactorily, is made entirely of iron, and weighs about 75 tons, exclusive of the engine and boiler. One of the most interesting features of the experiment was when the machine began to cut the rock in an oblique direction, for it was observed that those discs or arms which were cutting the stone, moved with the same facility that those did which were playing in the air. Gradually the cutters described their curve, the great face-plate of 17 feet constantly revolved, throwing out and drawing back its arms with complete regularity, seizing and crushing the rock with irresistible power. Only four men are required to work this machine to the greatest advantage; and two of them confine their attention to the engine which propels it. There is no necessity for suspending the work day or night, except for those intervals when the cutters have to be sharpened, or new ones substituted. The amount of time and expense which is saved by the operation is almost incredible. This machine evidently supplies a want which has been felt in every department of civil-engineering. It will revolutionize the whole system of railway construction, and is regarded as one of the most wonderful inventions of any age.—*Jameson's Edinburgh Philosophical Journal for July.*

Flax Breaker.—John Hinde, of Schenectady, New York, has taken out a patent for a new form of flax breaker. It consists in passing the flax straw between a ribbed or fluted endless apron, and a series of fluted rollers, which have a rolling motion over its surface. The action of this sheet or apron and the rollers, is intended to resemble the action of the human fingers in divesting the material of its woody substance.—*Scientific American, No. 41, June 24th.*

Sawing Machines.—John I. Squire, of St. Louis, United States, has invented some new improvements for re-sawing stuff which has previously been sawn out of the log, and making it into pickets, &c. A radius guide is applied to the saw for guiding it as it enters the stuff, insuring its true movement, and preventing its vibration. The saw is hung in a sliding frame, in such a manner that it (the saw) can be adjusted as it is worn by use; and it also permits of saws of different sizes being used. Feed rollers are placed within the sliding frame for gauging the stuff to be sawed, presenting it to the saw, and guiding it while being sawed.—*Scientific American, No. 40.*

Planing Wood Mouldings.—An improvement has been made in planing mouldings, which consists in the combination of feed rollers and stationary cutters, by which the mouldings are planed much faster than by hand—the method of finishing them at present. The rotary moulding machines now in general use do not finish the mouldings smoothly; indeed, the sides are not smoothed at all, consequently neat joints cannot be made of such stuff—but require the hand plane. This machine is designed to finish the work accurately.—*Scientific American, No. 40, June 17th.*

Mortising Machine.—Hiram and S. H. Plum, of Honesdale, Pennsylvania, have invented an improvement in mortising machines, which consists in the employment of two chisels, for cutting the ends of the mortise, and a reciprocating planer working horizontally, for cutting out the wood between the two end chisels, as the latter are forced gradually into the wood.—*Scientific American*, No. 40.

Improved Tenon Machine.—The great difficulty in the tenon machines hitherto constructed, has been the expense of time and labour, occasioned by shifting the timber from its positions, and often the employment of two machines on the same piece of work. C. P. S. Wardwell, of Lake Village, New Hampshire, has proposed to obviate this with an improvement, which shall combine all requisites in a single machine. His plan consists in a peculiar arrangement of vertical saws, for squaring the end of the rail, and for forming the shoulder, and horizontal saws combined, for cutting the tenons themselves, whereby a reversal of the rail is rendered unnecessary. By the addition of one or more cutters between the horizontal tenon saws, working in combination with the shoulder saws, the capacities of the machine are greatly increased. A suitable number of nuts and set screws, to keep these saws in the places to which they are shifted, to secure the desired angles of cut, completes the arrangement.—*Scientific American*, No. 43, July 8th.

Machine for cutting Shoe Welts.—S. I. and C. H. Trofatter, of Salem, Massachusetts, have invented an improved arrangement of machinery for cutting leather to be used for the welts of boots and shoes. The object effected is the cutting of two welts from the same thickness of leather at one operation, both being alike in every respect. When welts are cut by hand, only one is obtained, generally speaking, from one thickness of leather. This machine cuts out the welts with great rapidity, is neat and not expensive.—*Scientific American*, No. 40.

Improved Auger.—Isaac W. Hoagland, of Jersey City, New Jersey, has patented an improvement in augers, the nature of which consists in having the cutting portion of the auger made detached from the screw portion, and attaching the cutting part to the screw part by means of dovetails and screws. This appears to be an excellent improvement, for the screw part by this plan can be made to answer twenty cutting parts as they successively wear out.—*Scientific American*, No. 40.

IMPROVEMENTS IN THE MANUFACTURE OF TEXTILE FABRICS.

Improvement in Looms.—William Henley, of New Salem, North Carolina, has taken out a patent for important improvements in looms, applicable alike to hand and power looms, but made chiefly with a view to their application to hand looms. One improvement consists in a certain means of throwing the shuttle; and the other improvement relates to operating the harness, both of which derive motion from the lay, so that the swinging of the latter sets the whole of the loom in motion—in other words, by swinging the lay, all the working parts of the loom are moved. In common looms, the shuttle, the lay, and the harness, are operated by their distinct and separate movements. These improvements appear to be of great importance to the linen and muslin trade of Ireland and Scotland.

IMPROVEMENTS AND INVENTIONS CONNECTED WITH CHEMICAL PROCESSES.

Improvement in the manufacture of Bakers' Yeast, by M. C. Gutkind of Paris.—The new method consists in completely saccharifying the starch contained in barley. The barley is slightly malted, dried in a rapid current of warm air, taking care to prevent smoke coming in contact with the grain. The malt thus prepared is reduced to the condition of the finest flour possible, without bolting it; that is, the flour and bran should not be separated. This flour is introduced into a vat the size of which varies according to the quantity of yeast intended to be prepared at each operation. Water at a temperature of 40° centigrade (104° Fahr.) is introduced into the vat sufficient to make the flour into dough like that for making bread; this dough is then diluted with a further quantity of water, at the same temperature, to the consistence of porridge. M. Gutkind prefers using, for every 100 kilogrammes of flour (= 220·48 lbs.), 2 hectolitres (= 44 gallons)

of warm water. When the porridge is made, it is introduced into a boiler, where it is gradually heated to 81° centigrade (= 177·8 Fahr.) As soon as it reaches this temperature, the fire or steam, whichever be employed, is arrested, in order that the temperature of the porridge, become sensibly more fluid, may not pass that degree.

The liquid mass is now introduced into bags of canvass, and submitted to the action of a press, by which the essentially liquid portion, which is very saccharine, is squeezed out; this liquid is kept in large vats, where it cools. The solid matter remaining in the bags is again placed in a vat, and treated with a fresh quantity of water at 114° Fahr., in the proportion of 111 gallons of water to 441 lbs. of residue. The mixture is stirred so as to form a porridge, which is re-introduced into the boiler, and heated to a temperature of 201° Fahr., at which it is maintained for one hour. The mass is then pressed as before in bags of coarse canvass; the liquid which filters is less saccharine than that obtained by the first operation, but it is rich in nitrogenous compounds, which form the base of the yeast. The liquors resulting from both operations are mixed together, and are exposed to the action of the air in large uncovered vats during two, three, and even for ten days, according to the external temperature.

This exposure to the air is one of the chief points in the new method. In order to set the liquid in fermentation, it is re-warmed to a temperature of 89·6° Fahr., and a small quantity of fresh yeast stirred up in a little warm water added. The fermentation sets in very soon, and may be conducted either in barrels or in vats, around which a temperature of 59° Fahr. should be maintained during the whole operation.

The yeast obtained by means of this process possesses the following properties:—

1. The raising power is much superior to that of all other yeast; 2. it has no bitter or acid taste, and consequently is admirably adapted for pastry work; and 3. it is of an extreme whiteness, and consequently does not require to be washed—hence it preserves all its force.

The residue remaining after the fermentation may be employed to make vinegar.—*Le Genie Industriel*, June, 1854.

Natural Deposit of Saltpetre.—Prof. W. H. Ellet, of the United States, reports that there has been discovered in Bradford County, Pennsylvania, a regular vein of nitre, believed to be unique in its character. The nitre occurs as a solid and uncrystalline deposit in the horizontal seams of a sandstone rock, and in veins proceeding from them at different angles; and the rock itself, which is quite porous, is abundantly charged with the same material. The nitre itself is very pure, containing mere traces of nitrates of lime and magnesia. The sandstone in which it occurs is siliceous, containing a little carbonate of lime, and a notable quantity of silicate of potash.

ART. VI.—*Bulletin of Industrial Statistics.*

COMMERCE AND MANUFACTURES OF HOLLAND.

General Commerce.—Some of our readers may, perhaps, ask why it is we devote so much space to statistics, especially of countries with which we have little or no communication. We shall anticipate the question, by stating that we are influenced by three causes:—1st, we believe that one of the first elements of success in modern commerce is a knowledge of its exact condition in every civilized country; 2nd, that it is of great importance for the people of a country to be reminded that there are many nations in existence besides themselves, and that frequently these nations are silently making a far greater relative progress than ourselves; and 3rd, that the efforts which many of these nations are making may serve as examples and stimulants to us. To Ireland, such a lesson ought to be especially valuable, and accordingly we shall select Holland on the present occasion, because it is small,

poor in mineral resources, and has only its soil and some advantages from its geographical position on the delta of the Rhine, which makes it the seaport of a considerable part of Germany, to depend upon. And yet, what a noble position the industry and love of liberty of its inhabitants have raised it to in the scale of nations. That position, although not now equal to that held formerly, may well excite our envy. Holland was at one time very restrictive in her commercial policy, but within the last three or four years she has relaxed her tariff considerably, and made some very important changes in her navigation laws, not only as affecting her maritime commerce, but also her fluvial, all transit and navigation duties upon her rivers having been abolished. The result of these measures, as may be expected, was very satisfactory, and was even immediate, and there can be no doubt but that the beneficial effects will be still more apparent henceforward.

The results of the commerce and navigation of Holland for the year 1852, as compared with 1851, may be thus tabulated:—

Year.	Importations.		Exportations.		Transit.
	General.	For Home Consumption.	General.	The Produce of Holland	
1852	£ 27,901,795	£ 17,781,575	£ 23,558,567	£ 13,578,322	£ 9,980,244
1851	26,282,734	17,370,084	20,987,311	12,487,233	8,500,078
Mean for the Quinquennial Period	23,003,088	15,257,938	18,318,747	10,975,442	7,343,304

The relative proportions in which the chief articles of commerce entered into these importations and exportations may be thus stated:—

	Importations.			
	General.		For Home Consumption.	
Raw Sugar	...	11·9 per cent.	...	12·3
Manufactured Articles	...	11·6 "	...	12·6
Coffee	...	9· "	...	13·1
Yarns	...	9· "	...	4·9
Corn	...	8·2 "	...	7·2
Rice	...	4·1 "	...	4·9
Iron	...	3·5 "	...	2·
Dyeing Materials	...	3·1 "	...	2·
Cotton	4·2
Wood	3·6

	Exportations.			
	General.		Exportation of the produce and manufactures of Holland and its Colonies.	
Refined Sugar	...	8·8 per cent.	...	14·9
Coffee	...	8·5 "	...	13·
Manufactured products	...	7·5 "	...	6·
Yarn	...	7·1 "	...	—
Corn	...	6·9 "	...	5·4
Raw Sugar	...	5·1 "	...	2·
Butter	...	3·8 "	...	6·2
Cattle	...	3·5 "	...	5·7
Cheese	5·4
Dressed Flax	5·

NAVIGATION OF HOLLAND.

General Navigation.—The following table represents the condition of the navigation of Holland for the 22 years ending 1852:—

Comparative Table of the Navigation of the Netherlands, during the years from 1831 to 1852, inclusive.

CLEARED INWARDS.

Year.	Charged.						In Ballast.	
	Dutch.		Foreign.		Total.		Vessels.	Tonnage.
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.		
1831	1,995	229,436	2,545	314,933	4,540	544,369	403	25,772
1832	2,176	240,704	3,190	390,981	5,366	631,595	383	30,075
1833	1,616	152,864	4,093	448,990	5,709	607,854	352	23,225
1834	2,335	261,636	2,984	364,821	5,319	626,457	328	25,592
1835	2,367	278,372	2,754	275,664	5,121	654,036	333	20,079
1836	2,321	272,609	2,431	345,260	4,802	617,869	373	23,689
1837	2,565	306,931	2,822	418,510	5,387	725,441	400	27,664
1838	2,494	303,971	3,001	463,671	5,495	767,642	382	24,384
1839	2,727	345,807	3,452	594,916	6,179	940,723	466	29,906
1840	2,614	340,938	3,255	551,915	5,869	892,848	395	22,958
1841	2,608	363,166	3,161	510,727	5,769	873,893	385	20,904
1842	2,482	341,719	3,446	588,315	5,928	930,034	398	23,657
1843	2,476	363,805	3,377	589,921	5,853	953,726	337	20,089
1844	2,565	375,532	2,957	481,687	5,522	857,219	309	19,572
1845	2,851	394,596	3,364	518,310	6,215	912,906	356	25,990
1846	3,236	437,381	4,316	713,862	7,552	1,151,243	492	58,195
1847	3,239	447,275	4,127	667,668	7,336	1,114,963	334	35,762
1848	3,062	433,640	2,773	483,044	5,835	916,684	385	64,442
1849	3,296	452,812	3,123	557,336	6,419	1,010,148	707	66,416
1850	3,117	439,617	3,229	590,056	6,346	1,029,673	613	70,098
1851	3,104	460,884	3,345	629,014	6,449	1,089,898	509	74,220
1852	3,170	492,185	3,807	689,184	6,976	1,180,928	479	68,359

CLEARED OUTWARDS.

Year.	Charged.						In Ballast.	
	Dutch.		Foreign.		Total.		Vessels.	Tonnage.
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.		
1831	1,091	140,269	1,769	192,589	2,860	332,858	2,109	242,779
1832	1,132	141,435	1,826	206,279	2,958	347,718	2,872	334,003
1833	907	112,587	2,192	241,706	3,099	354,293	2,995	303,560
1834	1,373	186,238	1,854	220,015	3,227	406,253	2,505	266,515
1835	1,446	196,135	1,857	229,361	3,303	425,496	2,204	254,002
1836	1,532	209,741	1,882	240,130	3,314	449,871	1,831	217,490
1837	1,549	223,162	1,977	274,012	3,526	497,174	2,258	273,126
1838	1,716	238,953	1,865	261,778	3,581	500,731	2,359	324,844
1839	1,976	283,150	2,008	312,896	3,984	596,046	2,723	404,649
1840	1,853	271,223	1,789	264,570	3,642	535,793	2,656	388,267
1841	1,869	277,147	1,851	273,542	3,720	550,689	2,469	360,547
1842	1,800	275,638	1,741	263,690	3,541	539,328	2,826	442,081
1843	1,778	279,187	1,666	255,984	3,444	535,171	2,824	432,327
1844	1,942	282,787	1,666	273,277	3,608	556,064	2,279	358,732
1845	2,092	303,544	1,814	270,351	3,906	573,895	2,716	359,418
1846	2,008	290,016	2,218	352,819	4,226	642,835	3,829	574,906
1847	1,976	282,593	2,174	372,503	4,150	655,096	3,490	522,045
1848	2,189	307,960	1,784	324,926	3,973	632,886	2,751	389,057
1849	2,481	339,654	2,079	384,956	4,560	724,610	2,427	370,974
1850	2,467	365,008	2,274	407,625	4,741	772,633	2,276	364,231
1851	2,168	332,196	2,171	422,512	4,339	754,868	2,943	462,828
1852	2,450	375,594	2,308	443,798	4,758	819,392	2,950	495,487

This increase on the number of vessels and total tonnage has been accompanied by a corresponding increase in the mean tonnage. Thus, if we compare the mean tonnage for the years 1831 and 1852, we find the following results:—

		1831.		1852.	
		Inwards.	Outwards.	Inwards.	Outwards.
The mean tonnage of Dutch vessels was		114	129	155	153
" " Foreign	...	123	109	180	190
General mean	... ..	118	119	162	172

Of the total number of vessels engaged in the trade, not quite one-third, representing a little more than one-third the total tonnage, are owned by Dutchmen, a sensible increase has, however, recently taken place in both respects, the increase in 1852 over 1851 being 111 vessels, representing a tonnage of 27,358, as the following table shows:—

Comparative Condition of the Mercantile Navy of the Netherlands, on the 31st of December of the years 1851 and 1852, respectively.

Kind of Vessel.	In activity on the 31st Dec 1851.		Put out of service in 1852.		Newly constructed in 1852		In activity on the 31st Dec. 1852.	
	Vasls.	Tonnage.	Vasls.	Tonnage.	Vasls.	Tonnage.	Vasls.	Tonnage.
Vessels of three masts	145	112,944	4	2,098	2	1,604	143	112,450
Barques	262	146,474	3	1,554	35	18,006	294	162,926
Brigs	48	12,220	3	868	11	3,060	56	14,412
Schooners	107	17,442	6	824	32	4,908	133	21,526
Brigantines	3	668	..	...	...	...	3	688
Galiots	49	6,548	1	386	40	4,932	88	11,140
Sloops	796	95,230	45	4,948	55	5,482	806	95,764
Hookers	38	4,320	...	...	1	116	39	4,436
Steamers	12	3,692	1	318	2	576	13	3,950
Vessels of a mean capacity under 100 tons	400	21,932	26	1,540	22	1,210	396	21,602
Total ...	1,860	421,506	89	12,536	200	39,894	1,971	448,864

This improvement in the navigation of Holland may, in part, be attributed to the commercial reforms effected in Holland itself, on the one hand, and to the repeal of the navigation laws in England, on the other. Formerly the greater number of the large Dutch vessels had to go to the East Indies either entered in ballast or with insignificant cargoes, and on their return often remained a year in the docks in Holland; at present, as soon as they discharge their cargo in the Dutch ports, they go to England, where they get another for Australia or some port in British India, from whence they go to Batavia. This is a striking instance of the value of freedom of commerce, for while Great Britain and Ireland have derived immense benefits from the repeal of the navigation laws, every other nation has also derived more or less good from the measure.

Steam Navigation of Holland.—The following table shows the number of steam-boats which entered the Dutch ports in the year 1852:—

		Vessels.	
Coming from	Hamburg	75	19,894
	Zollverein	1	292
	{ Dutch Vessels	164	43,865
	{ English " ...	719	224,151
	{ " " ...	173	50,000 in ballast.
	{ Dutch Vessels	64	14,004
	{ French " ...	55	12,804
		cargoes.	

The number which cleared outwards was the same; in 1852 there was an increase of 72 vessels with cargoes inwards, and 64 outwards.

MANUFACTURES OF HOLLAND.

There is a gradual increase taking place in the manufacturing industry of Holland, and many articles are now exported that were, a few years ago, obliged to be altogether imported. The chief articles of manufacture are the following:—

Machinery, &c.—The factory of the Dutch steam company, at Feyenord, near Rotterdam, for the construction and repairs of steam vessels, employs about 700 persons, and continues to prosper. At Utrecht there is a factory for the repair of the locomotives belonging to the Rhine Railway Company. At Dordrecht there are three factories of some extent for boiler making, castings, &c.

Dockyards.—There are 128 small ship-building yards for the internal navigation, and 34 for maritime navigation, the former employ between five and six hundred, and the latter between 1000 and 1100 persons.

Spirit.—The manufacture of the spirit called Hollands is of great importance, the chief seat of it is Schiedam, where there are no less than 169 distilleries, all of them being very small compared with ours.

White Lead.—The white lead of Schiedam has long been celebrated for its quality, and the trade continues to prosper there and at Utrecht.

Madder.—The growth and preparation of this dyestuff has gradually become a great branch of trade; the chief seat is in the province of Zealand, especially in the neighbourhood of Middelbourg, where there are no less than 59 drying stoves in operation. The following table shows the relative state of this branch of trade, as shown by the quantity of madder, &c., exported in 1852, compared with 1846:—

		Madder Roots.		Ground Madder.		Garancine or prepared Colouring Matter. Value.
1846	...	55,483 lbs.	...	9,900,859 lbs.	...	£514
1852	...	2,271,958 „	...	13,162,034 „	...	100,959

Cotton and Woollen Fabrics.—Both these branches of trade are very steadily increasing, especially at Leyden, Tilbourg, where there are 16 factories, with 3,800 persons employed, Ammersfort, where there are 12 cotton-spinning factories, 12 weaving factories, 1 wool-carding establishment, 2 for making carpets, &c., and at Roermond, where about 3,000 persons are employed in both branches.

Refined Sugar.—The refining of raw sugar at Rotterdam is also a considerable branch of trade, and appears to be in a prosperous condition, although subject to considerable fluctuations of late. A great deal of the refined sugar used in Dublin comes from Holland.

The other branches of trade which seem to be extending are paper, glass, oil, cigars, soap, brick tiles, &c.—*Chiefly derived from Annales du Commerce Extérieur, No. 759, April, 1854.*

Peat Charcoal.

[We have received the following letter from Mr. J. W. Rogers, in reference to some observations made on his process of making peat charcoal, which appeared in the last number of this Journal. We are glad to be able to afford him an opportunity of correcting any statement which he thinks erroneous. He is correct in stating that in the system of turf-cutting practised at Derrymullen, in the County of Kildare, there was no wheeling, but it is our impression, that at the period of our visit to that place, a considerable time ago, the bricks of peat, when cut and laid upon the hurdles, were carried to the drying ground upon hand-barrows, a method which, it appears to us, would be perhaps quite as expensive as wheeling the turf to the drying ground. We were also told that wheeling

was sometimes substituted for the method just noticed. There are few questions of greater importance to this country than the introduction of a good economical system of turf-cutting, and Mr. J. W. Rogers would confer a benefit upon the Irish public if he would give such a detailed account of his system of turf-cutting as would enable it to be compared with other systems, and its advantages and disadvantages to be fully understood. With regard to the percentage of charcoal obtained, and which we stated upon data obtained at Derrymullen, we find, since the article was written, that it corresponds exactly with that given by M. Payen in a report of a visit to Derrymullen, which he made to the French Agricultural Society, about two or three years ago. Mr. Rogers must, however, be the best authority upon such a point.]

"TO THE EDITOR, JOURNAL OF INDUSTRIAL PROGRESS.

"SIR,—Permit me to draw your attention to the article in your last publication on '*Peat Charcoal for deodorizing purposes.*' In it you say that you 'doubt' the validity of the patent granted to me for this purpose, 'because many years ago, the distinguished Irish chemist, Richard Kirwan, suggested the use of *peat mould*, and *semi-charred peat*, for absorbing fetid fluids.'

"It is true you do not mention my name as the patentee, and I am quite satisfied you have no desire to damage my rights, but as I am the only party to whom a patent has been granted for '*the use of peat charcoal for deodorizing animal excrements,*' and am the *sole originator* of that proposition, (which, when brought forward, was not only doubted but ridiculed, even by scientific men.) I feel that you will do me the justice to insert this letter.

"First, allow me to say, that neither the use of '*peat mould*' nor '*semi-charred peat*' can interfere with my rights for the use of *Peat Charcoal*. Next, I believe it will be found that no publication is extant until the date of my first one on the subject, which points out the application of *Peat Charcoal to deodorize animal excrements and convert them into a manure.*' Since that time, and since the deodorizing powers of *peat charcoal* have been incontestably established, it has been more than once stated by my opponents, that '*the powers of charcoal in this respect were long known;*' but I have always failed to obtain from those parties specific information as to the name and date of any publication which even remotely suggested the conversion of the peat of Ireland into a pure charcoal, in order to deodorize and make perfectly free from evil to mankind the refuse of all towns. And I have the statement of the first chemist, perhaps, in the world, 'DUMAS!' made in the presence of the Emperor of France, to this effect—'that he had taught his pupils that *animal charcoal* had decolouring and deodorizing properties, but till then he did not know that *Peat Charcoal* possessed such powers.'

"If, then, I am the originator of the preparation of *Peat Charcoal* for such purpose, why should the knowledge that *animal charcoal* might effect the same end, but in which, from its price, it could never be availed of, deprive me of a just return for my labours? whether of mind or body is immaterial; and I may add, that the antiputrescent and absorbent powers of *Peat Charcoal*, properly prepared, far exceed similar powers in animal charcoal.

"With regard to the process of making *peat*, and the produce of *charcoal* under my patents, let me state the realities:—Immediately on being cut, the peat is piled on wicker hurdles, one above the other, and *there remains till dry*. You will see, therefore, there is no *wheeling* at all. The operation you have described was not under my patent; but your description of the *drainage* is perfectly accurate. By my process I have cut peat in *November and December*, and have made it into charcoal in February and March.

"The quantity of *charcoal* obtained by my mode of manipulation varied, at the Derrymullen works, when under my direction, from 33 to 36 per cent., not 23 to 25 per cent., and you are, no doubt, aware that, in fact, peat properly prepared will yield even a larger return of charcoal.

"As regards the value of peat charcoal as a manure itself, perhaps you will allow me at a future time to put facts before you which may be of interest to a country which has that material in every part in their easy reach, and with the use of which, in that way, my patent cannot interfere.

"With respect to the agricultural value of '*peat compost manure*' I shall also present to you, for the fullest test which your acknowledged capabilities can give them, samples of that which every part of Ireland may fully supply to itself as a substitute for guano.

"I have the honour to be,

"Your obedient servant,

"JASPER W. ROGERS.

"*Nottingham-street, Dublin, and Peat House, Robertstown.*"

Note on Turf Paper.

SINCE the publication of the article upon the manufacture of paper from peat, in No. VI. of this Journal, we have learned that a patent for a very similar process to that there described, has been granted for these countries to Mr. W. H. Clarke, of London. As the invention is stated in the specification to be a "communication," we presume it has been introduced either from Italy or France, and perhaps from the very localities which we have mentioned in the paper alluded to. The specification states that peat which has not undergone too great a decomposition or decay, and in which the fibrous and ligneous parts have consequently preserved a certain tenacity of texture, is to be washed with water, so as to remove sand and earth, the turf, if dry, having been first pulverised. This washing, or rather elutriation, is not considered to be necessary when papier machie or carton-pierre are to be made. The clean vegetable matter, before being reduced to pulp, is first soaked during a couple of days in a solution of about six parts, by weight, of potash, (soda would answer equally well,) and six of fresh slaked lime, in one hundred of water. When fully digested, the vegetable fibre is separated from the alkaline lye by washing, and is then submitted to the action of water moderately acidulated with muriatic acid during 24 hours, after which it is bleached and reduced to the condition of pulp by the ordinary means.

This process is identical with that of M. Lallemand, described in our former article. It is probable that the centrifugal machine, on the principle of that employed in sugar factories, might be advantageously employed in the purification of turf fibre, especially in the removal of the lye of soda, and that a far more perfect and rapid bleaching might be effected by means of a mixture of Epsom salt and bleaching powder, which would produce sulphate of lime and chloride of magnesia. This was one of the first bleaching compounds proposed, and was again employed by Clausen for bleaching flax cotton. Its use can only be determined by its cost; if Epsom salt can be had cheaply, and that the waste magnesia could be economized, there can be no doubt that the bleaching of such dark coloured fibres would be much more easily effected than with ordinary bleaching powder.

It appears that Lieut. Col. Dickson, of Croom Castle, in the County of Lime-
rick, has taken up this patent, and, in conjunction with Mr. Clarke, is erecting experimental works at Clonlahard and Tarbert, in the County of Kerry, where it is proposed to prepare materials for making paper, papier machie, carton-pierre, &c. We wish the project every success, and hope that it will not meet with the fate of the many other really feasible and valuable manufactures which have been from time to time attempted here, but which have failed from ill management. At this moment the success of such a manufacture is of National interest, for independent of the importance of utilizing peat, its employment to a large extent in the manufacture of the low qualities of paper, would go far to remedy the great scarcity of rags which now presses so heavily upon the paper trade.

THE

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ART. I.—*Notes on the Inland Navigation of Ireland.* PART I. By H. HENNESSY, M.R.I.A.

PUBLIC attention has been so much directed of late years to railways as furnishing the most important channels of internal communication, that the more simple means afforded by the physical structure of our country seem to have been almost forgotten. Railways are undoubtedly superior in many respects to any other system of inland conveyance; but, generally speaking, they can never be considered as forming so cheap a mode of transport as water carriage. This proposition is especially true with reference to Ireland, where most of the products of the country are such as to require economy rather than extraordinary speed in their conveyance, and where certain physical causes seem to present great facilities for lines of water communication.

But if, while the most recent and ingenious contrivances of engineering or mechanical skill are eagerly sought for and systematically applied to the improvement of railways, the state of inland navigation should receive but little comparative attention, the former, even under the peculiar circumstances of this country, would naturally tend to supersede the latter. On the Continent, and especially in France, the effect of railways seems to have been to direct attention in a very decided manner to the improvement of the existing water carriage. The results of science and experience have been brought to bear with fresh vigour on the twofold problem of improving the condition of the water ways and the structure of the vessels they convey. In these notes it is my object to briefly examine the natural advantages which Ireland possesses for an extended system of inland navigation, how these advantages have been hitherto availed of, and how they can be more effectually utilized by the aid of recent improvements.

A glance at a good physical map of Ireland shows it to be almost surrounded at its coasts by ranges of high hills or mountains, while a flat district of considerable extent occupies the centre. The principal groups of mountains thus situated are six in number: 1, that on the North-West,

occupying the counties of Donegal and Derry; 2, that of the West, stretching through Connemara in Galway and Mayo; 3, that of the South-West, in Kerry and Cork; 4, that of the South, in Waterford; 5, that of the East, in Wicklow and Wexford; 6, that of the North-East, in Down. In the central district there is only one group at all comparable in height and extent with any of these; it lies close to the Shannon, in King's County and Tipperary. The great number of lakes with which the central district of Ireland is covered, and the considerable length of some of her rivers, seem to be natural results of this peculiar configuration. These lakes and rivers are capable of being arranged in several principal lines, some independent and others branching from them. Thus we have: 1. The line of the Shannon, from Lough Allen to its mouth. 2. The line of the Connaught lakes, running from north to south, comprehending Loughs Con, Cullin, Carra, Mask, and Corrib, between the bays of Killala and Galway. 3. The line from Coleraine, through the Lower Bann, Lough Neagh, the Blackwater, and the lakes of Cavan and Fermanagh, towards the Shannon. 4. An offset from this line, through Lough Erne, towards Ballyshannon. 5. The Foyle and its tidal estuary. 6. The district of the Upper Bann, between Lough Neagh and Newry. 7. The important lines depending on the Shannon, namely, the Boyle Water and Lough Key, the rivers Suck and Inny. 8. The Boyne in its course through Meath. 9. The Barrow, through Carlow and Wexford. 10. The Suir in its course through Tipperary and Waterford. 11. The Blackwater from Mallow to Youghal.

The Shannon, with the lines of water way immediately dependent on it, forms by far the most important of these groups. This river may be said, for the purposes we have here in view, to rise from Lough Allen, a navigable basin, 8 miles long from north to south, and on the average 3 miles broad from east to west. This lake is 160 feet above the level of the sea, and possesses a mean depth of 12 feet. It is situated in a district known for its mineral riches, as yet almost unavailable, partly from want of cheap means of transport.

The following is a brief summary of the present condition of the Shannon from Lough Allen to Limerick. A canal extends from the north end of Lough Allen, at Drumshanbo, to Battle Bridge, with two locks, each of 10 feet fall. Thence to Carrick-on-Shannon, a distance of 17 miles from the northern extremity of Lough Allen, the river shoals in some places. At Knockvicar is a lock and weir in connection with the Boyle Water. At Jamestown, Roosky, and Termounbarry, there are three locks, each 110 feet long by 30 feet wide within the chambers, which effectually obviate the influence of the rapids in this portion of the river. In connection with the lock at Jamestown is a side canal, which allows of vessels of 30 feet beam. Below Lanesborough the river expands so as to form Lough Ree, 18 miles long and 3 miles in average breadth. At the south end of this lough, close to Athlone, a lock has been recently constructed with 7 feet fall, 170 feet long between its upper and lower sills, and 40 feet in breadth within the chamber. From this point to Portumna the river is broad, deep, and sluggish, requiring only one lock at Meelick, 32 miles above

Killaloe. This lock has a fall of 8 feet, and its other dimensions are the same as those of the Athlone lock. From Portumna to Killaloe the river again expands so as to form Lough Derg, an inland sea, 23 miles long and from 2 to 9 miles broad. Not only has the river channel been made deeper, and its declivity been graduated by locks, but its more easily navigable channels are indicated all along by a series of beacons placed at intervals, depending on the proximity of rocks or shoals. Wharves and landing-places have been recently constructed, and all the bridges on the upper division of the river beyond Killaloe are so arranged with swivels as to allow of the passage of large steamers and other vessels without any displacement of their masts or funnels. In this way 85 miles of navigation above Killaloe are open to steam vessels of 200 horse power and 150 feet long; while a smaller class of vessels can traverse nearly all the remaining portion of the river up to the northern extremity of Lough Allen, thus opening up nearly 150 miles of direct steam navigation. From Killaloe to Limerick the river has a fall of 97 feet in 15 miles, and is interrupted by rapids and cascades, chiefly at Doonass and Castle Connell. A very imperfect continuation of the navigation is formed by a canal, on which there are 10 locks, of such dimensions as would admit only barges of the size generally used on canals. The advantages thus presented for steam navigation on the Middle and Upper Shannon have been availed of by the City of Dublin Steam Company and by the proprietors of the Grand Canal. Steamers of large size, for the conveyance of goods and passengers, have been established by the former company, and run between Athlone and Killaloe; while the latter have introduced steam power chiefly for towing their barges on the river. In this way 5 or 6 tug steamers are continually employed. One of these boats has 50 horses' power, 15 feet beam, and draws 6 feet of water, being thus well qualified to contend against rough weather on the lakes. I have been informed that the company find small boats with powerful engines the most economical for the towing work, and accordingly most of their boats are little more than floating engine houses.

An estuary navigation of 44 miles extends on the Lower Shannon from Limerick to Kilrush, and steamers with a considerable draught of water are admissible. It has been navigated for several years by boats equally adapted for sea or river traffic, belonging to the City of Dublin Steam Packet Company.

The group of Connaught lakes already mentioned might perhaps with some difficulty be converted into a complete line of navigation, extending from Galway to the Bay of Kilalla; but there seems no doubt as to the practicability of forming two distinct lines, one connected with the former, the other with the latter of these arms of the sea. It has been estimated that the southern group, consisting of Loughs Mask, Corrib, and Carra, would require only three miles of canal to bring them into communication with the sea and with each other, thus opening a line of navigation at least 40 miles in length. Some progress has been made in the works for connecting Lough Corrib with Galway, but this line of navigation must still be considered as comparatively unopened.

The northern group of Connanght lakes, when properly connected by artificial works, would give a navigable line of 11 miles.

The third line of inland navigation which has been indicated as extending from Coleraine along the Lower Bann, through Lough Neagh, the River Blackwater, and the lake district of south-western Ulster, towards the Shannon, forms with that river a great system of internal water communication, running nearly in the direction of the longest diameter of the island, from north-east to south-west. It acquires additional importance from its situation in the midst of a populous and industrious division of the country, and it is therefore satisfactory to find that much information can be supplied regarding portions of it from the valuable report drawn up by Mr. MacMahon on the drainage of the Lough Neagh district. The Lower Bann is intersected by trap dykes at certain points, by which steep rapids are produced. The first is at 7 miles from the sea, and the difference of level in the stream above and below it is from 4 to $4\frac{1}{2}$ feet. From this point the water has a depth for some distance averaging 12 feet, the least depth being 9 feet, but it shoals, farther on, to 3 feet. From Loughan's Island to Gill's Ferry the water varies from 6 to 14 feet in depth. A few miles above this place there are two shoals, having an average depth of 4 feet 6 inches. Nine miles beyond the first rapid is another, combined with a shoal having a depth of from $2\frac{1}{2}$ to 3 feet, and an ascent of $3\frac{1}{2}$ feet. After these shoals come a series of rapids, with $10\frac{1}{2}$ feet ascent in summer, and a depth of stream between 2 and 3 feet. Beyond these rapids the river takes a serpentine course, and is of great depth, to the foot of the Portna Rapids, which are the most considerable on its course. These extend for at least a mile; but what are called the Falls of Portna do not occupy more than half a mile of the bed of the river. During low summer water the total ascent is 18 feet. The acclivity is divided into numerous irregular tables or steps, characteristic of the trap dykes. The stream runs with great force and velocity, and the deepest of the tortuous channels in which it flows are so intricate as to make it dangerous and difficult to guide even a fishing boat through their manifold windings. From Portna, for a distance of 5 miles, to a place called Portglenone, the river has a depth averaging 20 feet, the least depth being fully 16 feet. Above this place shoals occasionally alternate with deep water. The former are usually covered with water to the depth of from 3 to $4\frac{1}{2}$ feet, and in the deep places the depth ranges from 17 to 45 feet. This occurs in one instance for the distance of $3\frac{1}{2}$ miles, but the average depth seems to be from 10 to 20 feet. At the point where the river commences from Lough Beg a sand-bank acts as a bar to the down stream entrance of the lough. This lough extends $3\frac{1}{2}$ miles in the direction of the sailing course, and is about 1 mile broad. At its entrance is a new cut from 12 to 17 feet deep, and from 120 to 130 broad. There are four bridges on the Bann between Lough Beg and the sea, and another bridge between Lough Neagh and Lough Beg. At the entrance of Lough Neagh is a sand-bank, forming a bar which extends about a mile into the lake. It is 1,700 feet wide at the entrance, and in summer is covered to a depth of only 18 inches, except in a narrow channel at the eastern side. The greatest

accumulation of sand and gravel is principally on the western side of the lough, from the debris brought down by the River Moyola.

Lough Neagh, the largest lake in Great Britain or Ireland, extends 17 miles in greatest length from north to south, and 10 miles in average breadth from east to west. Its dimensions as regards direct navigation are thus scarcely of greater importance than those of some of the Shannon lakes. It presents, together with Lough Beg, a surface of 101,379 acres; exclusive of Lough Beg, its surface is 98,235 acres. It is 44 feet above the level of the sea, and in some parts is 100 feet in depth. It presents more than 100 miles of coast belonging to the counties of Antrim, Down, Armagh, and Derry, and it receives from the Rivers Blackwater, Upper Bann, Balinderry, and Moyola, the drainage waters of 1,865 square miles of country. The lough has been already navigated by steam vessels, which have been enabled to touch at different points around its extensive coast.

The River Blackwater is easily navigable between Lough Neagh and Charlemont, for it rises only 2 inches, and its channel is both wide and deep. Maghery Cut, at the opening, where there is a bar, allows the passage of large boats in summer. The Ulster Canal, with a course of 48 miles, connects this river with Upper Lough Erne and Lough Oughter. The aggregate coast lines of this lake and both of the Erne lakes amount to 203 miles. They contain many islands, but present no insuperable difficulties to the transit of moderately large steam vessels. Between Lough Oughter and the Shannon is a group of small lakes, which it is proposed to connect, so as to complete the line of inland navigation, extending from the coasts of Clare and Kerry to those of Derry and Antrim.

The Lower Lough Erne, being 150 feet above the level of the sea at Ballyshannon, seems to be almost cut off from any practically direct communication with the sea; but there can be no doubt that great advantages would arise to the surrounding districts by its forming a branch of communication from the nearest accessible point on the coast and the great line which has been just described.

The Foyle is navigable for a few miles of its course, and in connexion with the tidal lough into which it flows may yet form an important line of water communication for portions of Derry, Donegal, and Tyrone.

Between Lough Neagh and the Irish Channel, at Newry, a line of water communication exists in the district of the Upper Bann. This river is an expansion or arm of Lough Neagh, for a distance of nearly 12 miles, from the Bannwater foot to the White Coast point, where it meets the Newry Canal. It contains a few easily removable shoals, on which there is a depth of from 2 to 4 feet in summer, and is otherwise well adapted for the application of steam vessels. The canal to Newry is 19 miles long, thus making a line of more than 30 miles of navigation between the tidal estuary of that port and Lough Neagh.

The Boyle Water is a kind of expansion or arm of the Shannon, running to the North West, and is sufficiently deep for steam navigation. It

brings a large portion of Sligo and Roscommon into direct communication with the great central line of water-carriage.

The Suck, which flows through Roscommon, and enters the Shannon at Shannon Harbour, and the Inny, which rises among the lakes of Cavan and Westmeath, and falls into Lough Ree, are both eminently capable of being used for internal communication. They are free from rapids, sluggish, and comparatively deep. A report on the former of these rivers has been drawn up by Mr. Rhodes, in which it has been clearly shown that its improvement for the purposes of navigation could be effected at a moderate expense.

The Boyne, flowing for the most part through the flat and fertile County of Meath, seems to possess valuable conditions for a channel of internal traffic. In its sluggish course there seems to be few or scarcely any rapids, and its shoals are, no doubt, easily removable. About twenty-two miles have been already rendered navigable, including the tidal estuary below the port of Drogheda, and there appears to be no serious physical cause to prevent more of it from being used as a channel for commercial intercourse.

The Barrow, running nearly in the direction of the meridian, offers an important line of water carriage for the Counties of Kildare, Carlow, and Wexford. The locks which are used to overcome the declivities of this river are 60 feet long by 13 feet wide in their chambers, and are thus capable of admitting barges, or even small screw steamers, carrying a considerable cargo. Its tidal estuary is extensive, reaching from Waterford up to St. Mullins, and the portion between the former place and New Ross has been navigated by steamers. Combined with the navigable part of the Nore, it brings a part of the County of Kilkenny in contact with the sea, and its connexion with the Athy branch of the Grand Canal opens a complete water communication between Waterford and Dublin.

Some of the most fertile portions of Tipperary are traversed by the winding course of the Suir, and the most thriving towns of that county are situated on its banks. It does not seem to present any insuperable difficulties to the introduction of suitably constructed steamers on a portion of its course, although as yet it has been availed of for ordinary canal barges only between Clonmel and Waterford.

The most considerable river in Munster is the Blackwater, draining a basin of more than 1,200 square miles, partly in the Counties of Kerry, Limerick, Cork, and Waterford. The greatest annual fall of rain being in this part of Ireland, the Blackwater delivers a considerable volume of water into the sea at Youghal, and the rapidity of portions of its course, rather than an insufficient supply of water, would seem to be the principal obstacle to its forming a complete line of inland navigation from Mallow, or even Newmarket, to the sea. The question of its improvement acquires additional importance since it has been crossed at Mallow by the Great Southern and Western Railway, and it is to be hoped that the enterprising attempts made some years ago to establish steam navigation on a portion of it will be again revived with fresh vigour.

Although the navigation of the tidal estuary of the Lee can scarcely be considered as coming within the scope of this essay, it deserves to be noticed, as its excellent management may well serve as a model. There are at present seven steamers employed for passenger traffic, on the estuary between Cork and the sea, all capable of traversing their course at any time of tide, of which four belong to the Cork and Passage Railway Company, and three to the River Steamers Company. The boats in use present very favourable specimens of the types of steam-boat building of the Thames and Clyde, respectively, but there is good reason to hope that for the future such vessels can be equally well obtained on the banks of the Lee itself. By means of these boats an extensive daily traffic is carried on between Cork and five points on the shores of its harbour and tidal estuary, and it is intended to bring two more in a short time within the circle of their operations. The great success of these boats is, undoubtedly, attributed to their very moderate fares, as well as to their speed and excellent accommodation for passengers.

The foregoing sketch of the natural advantages possessed by Ireland for inland navigation, and the extent to which its rivers and lakes are now available for that purpose, naturally leads us to inquire when, and in what manner, attempts to form systems of water carriage were made in this country? To give a satisfactory answer to such an inquiry it will be necessary to glance at the history not only of river improvements, but of artificial canals; a task which is much facilitated by a paper drawn up by Mr. Nimmo, and subsequently published by Mr. Wye Williams. The remarkable preponderance of the number of projects planned, over those actually executed, forms a curious comment on the political and social condition of this country.

In the first parliament of Anne, in 1703, a committee was appointed to draw up a bill for rendering the Shannon navigable from Jamestown, in the County Leitrim, to its tidal estuary at Limerick; also for opening a line of water communication between Newry and Lough Neagh, and for improving the Boyne and Barrow.

In 1709 a bill was brought in for the navigation of the Shannon, and for the Newry Canal. A petition was presented in the same year for making the Suir navigable between Thurles and Clonmel, and also to effect certain improvements on the Barrow.

In 1715, some enterprising projectors having undertaken to make the Shannon navigable, a general act was passed for the consolidation of all similar undertakings. This remarkable act is entitled, "For the draining and improving the Bogs and unprofitable Low Grounds, and for easing and despatching the inland carriage and conveyance of goods from one part to another within the kingdom."

The Members of Parliament with others were declared commissioners, with powers under this act to appoint competent persons to execute the works, and the following groups of improvements in river navigation, or of entirely artificial canals, were successively contemplated and partly commenced.

1. A line from Dublin by the rivers Liffey, Rye, Boyne, Mungagh and

Brusna, to Banagher on the Shannon. The district which this line was to traverse has since been occupied by the two great canals which run through the central portions of Ireland in such singular proximity to each other. In fact, the Grand Canal may be considered as forming almost the realization of this project; for it runs very close to some of the above-mentioned rivers and joins the Shannon not far from Banagher.

2. The Barrow navigation, and a junction canal from thence to the Grand Canal at Munroe in the Bog of Allen. To this reference has been already made.

3. Improvements of the rivers Glyn and Bann, from Newry to Coleraine. The portion between Lough Neagh and Newry has been finished.

4. The Nore and Brusna navigation, from the junction of the former with the Barrow to the Grand Canal near the Shannon. Several docks and other works have been made in connexion with the Nore, but this line seems to have been soon abandoned.

5. Improvement of the Liffey and Greece from Dublin to Kilcullen and Carlow. The branch of the Grand Canal known as the Kildare Canal, runs very nearly in the district which this navigation was to open.

6. The Blackwater, from Youghal to Newmarket. It has been rendered navigable from Youghal to Lismore, and, a few years ago, a small steamer was plying on this portion of the river, chiefly for passenger traffic; but as yet its capabilities, as a channel for the conveyance of goods, seem not to have been at all brought into operation.

7. The Foyle, Mourne, and Strule, from Derry to Omagh. This has been completed only to Strabane.

8. The river Erne, above Lough Erne, [unattempted.]

9. The Maigue, from Limerick to Cork. Some improvements have been effected in this river by the Shannon Commissioners, but the proposed line between Limerick and Cork has been long since abandoned.

10. The Boyne navigation, from the Grand Canal to the sea, at Drogheda. This has been effected, as already mentioned, from Navan.

11. From Sligo to Carrick-on-Shannon. This line seems to run nearly in the direction of the Boyle water, and is thus so far partly open.

12. From Galway to Killala, through the lake district of Western Connaught. This line, as already referred to, must be considered as unopened.

13. The Slaney, from Wexford to Baltinglass, [unattempted.]

14. The Suir navigation, from Thurles to Waterford. This has been improved only between the latter town and Clonmel, so as to admit of ordinary canal boats.

15. From Galway to Portumna on the Shannon, [unattempted.]

16. The river Inny, from Lough Sheelin to the Shannon, [unattempted.]

17. The river Suck, from Castlereagh to the Shannon. The Shannon Commissioners have turned some attention to this river, but it does not seem to have been as yet rendered completely navigable.

18. The Lee, from Cork to Macroom. A few locks were constructed, but the works were soon suspended, and nothing has been effected since.

19. The river Bandon, from Kinsale to Dunmanway. Ships, such as

are used in the coasting and channel trade, can proceed up the tidal estuary of this river as far as Shippool, a few miles below the town of Bandon; and a ship canal was proposed, some years ago, to connect the estuary with the town, for which surveys and estimates were made. This useful project has, however, been abandoned, and is not likely to be resumed, in consequence of the Cork and Bandon railway.

20. The Laune, from Rosscastle to Castlemaine harbour, [never attempted.]

The provisions of the Act of 1715 not having been found sufficiently encouraging, another was passed in 1729, better adapted in some respects to stimulate the carrying out of the several proposed improvements. New Commissioners were appointed, and, by the 25th of George the Second, they were incorporated with full powers of improving and extending inland navigation. Certain duties were from time to time imposed, and specific grants accorded, in furtherance of these objects. For many years the Commissioners had expended the sums placed at their disposal on the Newry navigation. In 1749 their expenditure amounted to £58,400. After this they commenced other works on the Boyne and Shannon, the expenditure on which, in 1758, amounted to £140,000.

In the 27th of George the Second an act was passed to open a navigation from Belfast to Lough Neagh. This is what is now known as the Lagan navigation; it was commenced in 1755, and received improvements in 1810. A new act was passed in 1843 for deepening it from the first lock towards Belfast, so as to admit vessels of from 50 to 70 tons burthen, and drawing 5 feet of water. This navigation is remarkable from an official testimony to its success, quoted by Mr. MacMahon, from which it appears that it has been but little affected by the Ulster railway, and for all heavy goods it is expected to command a preference. In this opinion Mr. MacMahon concurs, stating that he has long entertained the conviction that canals and railways in the same locality are not necessarily competing highways.

At the period referred to of the reign of George II., when the entire revenue of Ireland scarcely exceeded half a million, the Legislature voted £65,000 for inland navigation. This was done chiefly on the representations of the Tillage Committee, by whom the subject was strongly recommended on account of the great benefits resulting to agriculture.

In 1767 the system of management underwent a change, devised in order to stimulate private enterprise. For, while granting £6,000 for improving the Lower Shannon, the condition was annexed that £10,000 should be raised by private individuals, and in conformity with this arrangement the Limerick Navigation Company was duly incorporated. Some years after this the corporation for the general management of inland navigation was dissolved, and several lines of water communication that had been undertaken, were vested in bodies of local commissioners; such, for instance, occurred to the Newry Navigation, the Boyne, the Barrow, the Upper and Middle Shannon, and the Tyrone Coal Canal.

In 1789 the Irish House of Commons resolved to advance one-third of the expense of any new undertaking of this kind, and authority was

given to issue debentures at 4 per cent for £200,000, the sum raised in one year not to exceed £25,000.

This liberal provision soon caused the following lines of navigation to be carried on, for which public money was allocated to the extent of £189,200.

1. The Shannon, between Killaloe and Limerick.
2. The Grand Canal to the Shannon.
3. The completion of the Barrow Navigation.
4. The Royal Canal, from Dublin to the Upper Shannon at Termonbarry.
5. The Boyne Navigation, above Drogheda.
6. The Newry Navigation.
7. The Erne Canal.
8. The Kildare Canal, to Naas and Kilcullen.

The sum of £33,399 was further appropriated by the 31st of George III. for the following improvements: the Athy branch of the Grand Canal, the Grand Canal docks, the Foyle navigation to Strabane, and the Collieries Canal. From a report of the Commissioners of Accounts in 1790, the Corporation for promoting inland Navigation in Ireland had disbursed of

Public Grants,	...	£227,669	2	1½
Income for Duties,	...	359,868	9	6½
		<hr/>		
		£587,537	11	8

At the Union in 1800, a sum of £500,000 was granted for improving the Port of Dublin, for rendering the Shannon navigable from Lough Allen to the sea, and for the general purposes of inland navigation. Under this arrangement £423,798 were granted partly to the Royal Canal Company, the Barrow Navigation, the Grand Canal Company, for improving the Shannon between Lough Ree and Lough Derry, the Limerick and Killaloe Navigation, the Newry Navigation, the Tyrone Canal, and the improvement of Dublin Harbour. Subsequently by the 57th George III. cap. 34, £300,000 was advanced for different works, no part of this grant going to the Shannon. After so many years of comparative neglect, the capabilities of this noble river were at length destined to be fully recognised, and to be in some measure availed of by the exercise of engineering skill and judicious legislative arrangements. The Shannon Commissioners were duly incorporated, and plans for the improvement of the river were submitted to Parliament every year from 1836 to 1839, inclusive. The entire estimates amounted to £510,750 15s. 9d., and the money awarded for compensation to mill owners, land owners, proprietors of fishery rights, &c. reached the sum of £74,054 2s. 0½d. The Shannon was thus not only brought to the navigable condition already described, but communication between its opposite banks was further facilitated by the construction of several noble bridges; and it is to be hoped that the prosecution of improvements of every kind of which the navigation of the river has been the object, have not as yet been altogether abandoned.

From this short sketch of the history of inland navigation in Ireland, the

liberality with which the subject was entertained by the Irish Parliament is as remarkable as the occasionally injudicious application of the funds so amply provided. Sums comparatively small were appropriated for the improvement of the great natural lines of navigation, while far more encouragement was given to lines entirely artificial, more especially to the two great competing canals which connect Dublin with the Shannon. Thus the general interests of the country are frequently sacrificed to individuals or corporations who may exert an active and interested personal influence on those to whom the conduct of public affairs happens to be entrusted.

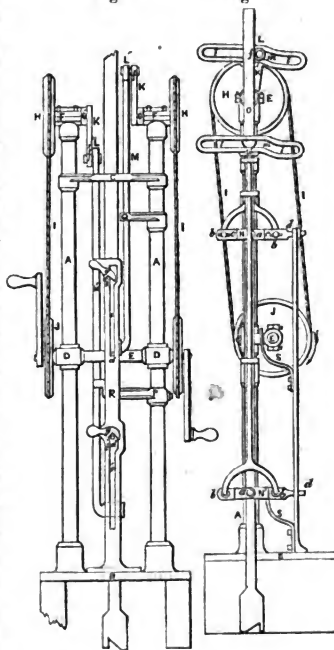
ART. II.—Wright's Stone Drilling Machine.

THERE is a considerable source of wealth in Ireland, which has hitherto been almost unproductive—namely, the varied and extensive beds of marble which occur throughout the country. If proper machinery was applied to work them, and afterwards to fashion them into chimney-pieces, architectural ornaments, &c., there can be no doubt that a large and lucrative trade would spring up. With the object of directing attention to this subject, we shall bring under the notice of our readers any new machines adapted for quarrying or working stone, and shall accordingly commence with a description of an American machine, lately invented by William C. Wright, for drilling stones.

The nature of the invention consists in a certain arrangement and mode of operating two sets of grippers, whereby one set is caused to grasp and carry up the drill bar, while the other set slides down the bar previous to renewing their grip, and the drill bar is liberated from both pairs of grippers,

Fig. 1.

Fig. 2.



and let fall at the end of every upward movement. This arrangement allows the drill to strike two blows during every revolution of the driving shaft, and saves the time lost in raising the bar when only one set of grippers is employed, as one set is always raising and also gripping the bar, except during the short interval when the drill bar falls. Fig. 1 is a back elevation of this machine, and fig. 2 is a sectional side elevation, the same letters referring to like parts.

A A are two wrought iron uprights, which are secured firmly to a base, B, of cast iron or timber, and are stayed by a cross tie, C, near the top. At about the middle of the height of the uprights are secured the boxes, D D, which form the bearings of the horizontal driving shaft, E, which is furnished with cranks, by which rotary motion is given to it. At the top of the uprights are secured the boxes, F F, which form the bearings of two short shafts, G G¹, which carry each sprocket wheel, H, receiving rotary motion through an endless chain, I, from one of two sprocket wheels, J J, on the driving shaft. The two shafts, G G¹, stand in line, and are furnished at their adjacent ends with two cranks, K K¹, which stand on diametrically opposite sides of their common axis. The cranks are furnished with wrists, *f f*¹, which enter slotted heads, L L¹, at the top of the upright rods, M M¹, whose lower ends are forked to carry the grippers, N N¹, which seize the drill bar.

The drill bar, O, is parallel with the uprights, A A, and is placed midway between them, being fitted to work in two guides, one of which is in the cross tie, C, and the other in an arm, P, below. The rods, M M¹, which carry the grippers, are on opposite sides of and nearly close to the drill bar, and they work in guides in the cross tie and in the arms, P and Q, below. The rod, M¹, is much longer than the other rod, M, as the grippers must occupy such positions, that when the upper set have descended, and the lower set ascended simultaneously, they will clear each other. The nippers are of a form substantially like some of the nippers in use for similar purposes, the two jaws being hinged together by lugs, *a a*, on opposite sides of the drill bar, and each jaw being suspended on a horizontal pivot, *b*, at the end of one prong of the fork on the rod. The jaws are made heavy at the ends, and are so formed that their weight makes them grip the drill bar when they hang free, but that when the ends are raised they will release the bar. The holes, *c c* (fig. 2), which receive the pivots, *b*, of the fork, must be elongated in order to allow the grippers the necessary motion to grip and release the bar. At the back of the pivot, *b*, of the back jaw of each pair of nippers is a shank, *d*, which passes through one of two slots, *e e*¹, in a light upright standard, R, which is secured to the base, B, behind the drill bar.

The slots, *e e*¹, in the standard, R, are of such length that they will allow the shanks, *d d*¹, of the nippers to move in them as the nippers are raised and lowered by the revolution of the wrists of the cranks in the slots, L L¹, at the top of the rods, M M¹, but that each shank will strike the top of its slot just before the grippers arrive at the top of their upward stroke, and arrest its upward movement, after which the continued upward movement of the gripper rod causes the jaws of the grippers to be tilted

up, and thereby opened to release the rod, which during their ascent they have gripped and carried up. The slots, $e e^1$, are both straight for the greater portion of their length, and of a proper width for the shanks, $d d^1$, to pass easily, but they are both curved outward on one side, and thus widened from a short distance below the top to the top, and on the opposite side of each is suspended by a pivot, h , a small arm, g , whose end rests upon a pin, i , which prevents it falling. The end of this arm is furnished with a hand or angle piece which, when the arm rests on the pin, i , lies across the slot. As the shank of the grippers arrives opposite the widened part of the slot, it comes in contact with the hand of the arm, g , and as it continues ascending, raises the hand, which, moving in an arc, throws the shank laterally across the widened part of the slot. The grippers at that time holding the drill bar continue to turn it until the shank strikes the top of the slot and causes it to be released.

The slot in the heads, $L L^1$, of the gripper rods in which the cranks work, to give the rods a reciprocating motion, consist each of two straight parts, $l l$, one a little above the other, at right angles to the rod united by a step, m , which is of the form of an arc described with the radius of the crank. The arc-formed step, m , descends from the central point in the slot, and allows the crank wrist, after having raised the rod to the highest position, by passing along the long straight part of the slot, to move in the slot for some distance before commencing to drive it downwards. The object of this is to leave the nippers, which have raised the bar, open, after having released it, for a sufficient time to allow it to fall. There are stop pieces, $S S^1$, attached to the front of the standard, R , to open the grippers which have descended, and thus both sets of grippers are opened when the bar falls.

Suppose the drill bar to have just fallen after having been raised by the upper set of grippers, N , (fig. 2). The wrist, f , of the crank, K , will be seen in fig. 2 to be moving down the arc, m , of the slot in the head, L , of the gripper rod, M , consequently the rod is not moving. Both sets of grippers are open; the upper set in consequence of the shank, d , being depressed by the top of the slot, e , in the standard, R , and the lower set in consequence of the jaws being tilted by the stop, S^1 , in the lower part of the said standard. As the motion of the shafts and cranks continues, the first half of the revolution of the wrist of the crank, K^1 , will raise the gripper rod M^1 , and the lower set of grippers, N^1 , and as soon as the said grippers are raised clear of the stop, S^1 , the jaws will fall of their own weight and grasp the drill bar, whose friction and weight will draw them tight. In the meantime the crank, K , after its wrist passes down the arc of the slot in the head, L , drives down the rod, M , and the upper set of grippers. The downward motion of these grippers on the rod, and the upward motion of the rod through them, both tend to prevent their gripping the rod, so they slide down easily. When the shank of the grippers, N^1 , reaches the hand of the arm, g , they raise it, and in ascending, this hand turns the drill bar, by forcing the shank towards the widened or recessed part of the slot, e^1 , where it remains until the descent of the grippers. When the shank, d , reaches the top of the slot, and its upward

progress is arrested, the grippers, N^1 , being opened allow the bar to fall. The next half revolution of the cranks will cause the wrist of the crank, K , to raise the gripper rod, M , and grippers, N , which will raise the drill bar, while the wrist of the crank, K^1 , after descending the arc, m , of the slot in the head of the rod, M^1 , will force down the grippers, N^1 . Before either pair of grippers are opened after raising the bar, the pair which have in the meantime descended are also opened by coming in contact with one of the stops, $S S^1$, on the standard, R , and these grippers remain open during the latter part of their downward stroke, and the early part of their upward stroke; this is necessary for the same reason that the descent of the nippers which have raised the bar is for a time arrested—viz.; because if the nippers were not kept open and clear of the bar during its descent, the friction of the bar within them would draw them tight. The continued operation of the machine is but a repetition of that described, every revolution of the driving shaft giving two strokes to the drill bar.

There are three sizes of these machines; No. 1 is constructed to drill a hole 7 inches in diameter and 100 feet deep; No. 2, from 2 to 3 inches in diameter; and No. 3 is a small machine for getting out blocks of granite, &c. It is a simple and good machine, not liable to get out of order, is easily worked, and capable of drilling all kinds of stone—hard granite and soft freestone. It is capable of many useful applications besides making ordinary quarrying bores.—*Scientific American*, July 1.

ART. III.—On the Cost of Cutting Peat and Making Peat Charcoal in France.

THE cutting of turf in this country having hitherto been entirely in the hands of the agricultural classes, the same absence of all accurate numerical data, which was so characteristic of farm management, and, we regret to say, is even to a large extent still so, applies equally to that operation. So much is this the case, that we believe it would be nearly impossible to obtain in Ireland any reliable information upon the weight of dry turf which a given number of cubic feet of moist peat would yield, or the cost per ton at which turf fuel could be raised in any given district. This absence of accurate numerical data has led to the most conflicting opinions as to the economy of peat as a fuel for manufacturing purposes, and has consequently retarded to a great extent its employment. In order to encourage those who may have an opportunity to supply the data to which we allude, we shall show the mode in which a French proprietor understands the value of a turf bog, by the following statement relative to the working of the bogs of Mont César, near Liancourt, the property of the Marquis de Villette, for which we are indebted to the kindness of Mr. Rees Reace.

The stack or clamp of turf at Mont César has a solid content of a *decastère* or *myriolitre* = 353·1661 cubic feet. It is 4·3645 yards long by 2·46067 yards wide at the base; at 18 or 24 sods high, it is 1·958539

yards; and when thoroughly dry, measures 1·3670 yards high—measured up to the very top. It has a superficies of 8 metres square = 9·5682 square yards, and a volume of 10 stères or cubic metres = 353·1661 cubic feet; that is, 2·5 stères per metre in length, or 80·730 cubic feet per yard. Such a clamp contains on an average 12,000 sods of moulded turf (*tourbe moulé*), or 8,000 sods of ordinary or slane turf. The sod of slane turf, fresh cut, contains 3,800 centimetres cube = 231·9026 cubic inches. A metre cube (= 35·3166 cubic feet) of bog therefore contains $\frac{1,000,000}{3,800} = 263·15$

sods; the clamp of turf containing a decastère is therefore the produce of 30·4 cubic metres, or 3·04 decastères. A cubic metre of bog only gives therefore 0·33 of a stère of dry clamped turf, or, in other words, a given volume of bog cut into sods will give about one-third of its volume of clamped turf. This is, however, not the whole diminution of volume which turf sustains in drying; the real loss which a solid mass would suffer would be from three-fourths to four-fifths, and even in some cases as much as seven-eighths. In a clamp of turf the spaces between the sods make up the difference.

A stock of 1,000 such stacks or clamps, or 100,000 decistères or hectolitres = 353,166 cubic feet, or 13,080 cubic yards, each decistère = 3·53166 cubic feet, weighing from 30 to 40 kilogrammes = 66·145 lbs. to 88·194 lbs., according as it is ordinary or bricked turf, is the produce of $1\frac{1}{2}$ hectares of bog (a hectare is equal to 11960·3335 square yards), the bog being 2 metres = 78·74 inches deep. It is considered that 15 turf-cutters are capable of producing this quantity in the course of the season. If we reduce these data to an English standard, we would have, as the work of 15 men for a season, 13,080 cubic yards of stacked turf, each weighing from 512·5 lbs. to 674·2 lbs., or a total of from 2992·6 tons to 3,936·8 tons; 8·1 acres of bog 1 yard deep would yield these quantities; and 1 acre at Mont César, 1 yard deep, would yield on average 1,613 cubic yards of clamped turf, weighing from 369 tons to 485·4 tons. The turf here spoken is of superior quality, and corresponds in quality to the black turf of our bogs. An acre of the light flow peat of our bogs, 1 yard deep, would not yield, according to these data, more than from 140 to 150 tons of dry turf; and of our ordinary good brown turf, of which a cubic yard generally weighs about 350 lbs., not more than from 250 to 260 tons.

The cost of a stack of ordinary slane turf, containing say 8,000 sods, and having a cubic content of one decastère, may be thus estimated:

		Francs.	Francs.
Cutting ... ..	...	10·40	
Clamping, inclusive of footing	...	4·55	
Thatching ... ..	...	0·50	
		<hr/>	15·45
Rent of bog ... ..	...	6·55	
Straw for covering	...	2 00	
Boating to factory	...	1·60	
		<hr/>	10·15
		<hr/>	
Total ... ..	...	...	25·60

A ton of dry turf delivered at a factory close to the bog would then cost, on an average, 8·67 francs, or 7 shillings.

Moulded turf—that is, turf made somewhat like bricks in a mould, and corresponding to our hand turf—is usually made in smaller sods than slane turf, as it is chiefly used for making charcoal to be used for fuel. For if too large sods were used they would be more liable to crumble when charred. Moulded turf being also denser than slane, is better adapted for making charcoal for fuel, which requires to be dense, in order that it may bear carriage. A stack of moulded turf, of one decastère in volume, and containing 12,000 sods, is estimated to cost as follows:—

	Francs.
Cutting, including spreading and first footing	18·0
Clamping	2·40
Thatching	0·40
	<hr/>
	20·80
Rent of bog, straw, &c.	10·15
	<hr/>
Total	30·95

This would be 7·86 francs = 6s. 4d. per ton.*

One thousand clamps of moulded or brick turf would therefore cost 20,800 francs (£832) in cutting and clamping, and 10,160 francs (£406) for rent of bog, &c. This quantity supplies two sets of coke ovens for one year, each set consisting of 4 brick retorts, set in pairs opposite each other, with the chimney in the centre. The capacity of each retort is 166·55 cubic feet, and it would therefore hold very nearly 2 tons of turf, which is charred in about 35 hours on an average. A set of retorts of this kind costs about 10,000 francs, or £400.

The whole of the turf is not, however, fit for making charcoal, as one-fifth would be too small to put into the retorts; it is, however, useful in the factory for firing the retorts; 1,200 clamps of brick turf are therefore required in order to produce charcoal equivalent to 1,000 clamps; and in addition, 200 clamps of ordinary slane turf to be used as fuel for heating the retorts. The cost of the entire turf required is therefore:

1,200 clamps of brick turf	24,960
200 of ordinary turf	3,090
	<hr/>
	28,050
Bog rent, &c.	14,210
	<hr/>
Total	42,260

This quantity represents nearly the entire turf of 2 hectares of bog 2 metres deep, or 4·94 acres 6 feet 6·74 inches deep, and would be the work of about 21 cutters for the season. The cost of converting it into charcoal may be thus estimated:

18 charcoal burners at 1·75 francs	5,110
One as foreman at 15 francs per month extra ..	180
	<hr/>
Total	5,290

* Calculating the franc at 9·69 pence.

The produce is considered to be, on an average, 1,000,000 kilogrammes, or in round numbers 1,000 tons of charcoal fit for sale; under the most favourable circumstances, that is, assuming a decistère to weigh 40 kilogrammes, or a cubic yard, 674·2 lbs., and that $\frac{1}{3}$ of the peat was obtained as charcoal, the produce, without deducting dust, waste, &c., would be a little over 13,000 tons. Taking it at only 1,000 tons, the whole expenses would be as follows:

1,400 clamps of turf	...	...	...	28,050 francs.
Labour in converting the turf into charcoal	...	...	...	5,290 "
Rent of bog, &c.	...	...	...	14,210 "
Wear and tear on ovens at 5 per cent., upon 20,000 francs	...	...	...	1,000 "
				<hr/>
				48,550 francs,

or £1 19s. 2d. per ton. If we suppose the produce of charcoal to be 13,000 tons, of which 1000 would be fit for use as fuel, and 300 as crumbled charcoal for grinding, to be employed as a deodorizing agent, the average cost of the whole would be only £1 10s. 1d. The use of the waste charcoal for this purpose will therefore be a great benefit to charring establishments like that of Mont César.

The most striking feature in these statements is the large sum paid as bog rent. While bogs averaging 24 to 30 feet in depth are lying waste with us, a hectare, or less than $2\frac{1}{2}$ statute acres, is worth, in the district of Mont César, 5,000 francs, or £200; and the surface, or spreading ground, for drying the turf, brings a rent of 50 francs, and yet the bogs of that district are only a few yards in depth.

In the article upon peat charcoal in No. VII. of this Journal, for July, 1854, we estimated the cost of charring at Crouy-Sur-Ourcq at from 3s. to 4s.; in East Friesland, at from 4s. to 5s.; at Weierhammer in Bavaria, at 4s. 3 $\frac{1}{4}$ d.; and at the Carolinen Hütte, near Achthal in Styria, at 4s. 4d. It is interesting to find that the cost at Mont César does not materially differ from those estimates: supposing the produce of charcoal to be 1,000 tons only, and including wear and tear of furnaces, the cost would be very nearly 5s. 1d. With a produce of 13,000 tons it would only be 3s. 10 $\frac{1}{2}$ d.

At the charring establishment of M. Coron, at Dury, near Ham, in the department of Aisne, the cost of cutting turf is as follows:

Slane Turf.

Cutting 1,000 sods	...	...	3·50 francs.
Spreading and footing	...	...	1·00 "
Carriage	...	...	1·00 "
Covering, wear and tear of boats	...	...	0·50 "
			<hr/>
			6·00 francs.

Each sod measures 18 inches long and 4 inches wide and thick, and weighs 1,400 grammes; so that one ton would cost, under these conditions, about 3s. 6d.

Brick turf in small sods for Charcoal.

Cutting per 1,000 sods	...	...	0.65 francs.
Moulding	...	...	0.95 "
Drying and clamping	..	...	0.25 "
Carriage, inclusive of sacks, &c.	...	...	0.35 "
Thatching	...	...	0.10 "
Wear and tear of tools	...	...	0.20 "

 2.50 francs.

Turf of this kind is cut directly out of water 4 feet deep; each sod measures 8 inches in length and 4 inches wide and thick, and weighs, on an average, 300 grammes. A ton of such turf would therefore cost 6s. 10d. nearly.

Brick turf in large sods for domestic purposes.

Cutting per 1,000 sods	...	...	1.15 francs.
Moulding	...	...	1.75 "
Drying and clamping	...	...	0.50 "
Thatching	...	...	0.15 "
Carriage	...	...	0.50 "
Baskets for ditto	...	...	0.10 "
Other tools	...	...	0.20 "

 4.35 francs.

Each sod weighs 800 grammes, a ton of such peat would therefore cost about 4s. 5½d. A hectare is supposed to yield 28,800,000 sods, the depth of the bog being 5.30 metres, or 17 feet 4.6 inches; or 5 metres, or 16 feet 4.8 inches of good turf, exclusive of skraw and light moss peat. A hectare of such a bog is considered to be worth 25,000 francs, or £1,000!

There are 10 charring furnaces at Dury, but as we have no data as to the cost of charring, we shall not describe them further.

We hope the few facts which we have brought under our readers' notice, will show them the importance of our having accurate data upon a matter of such immense importance to this country as our peat bogs, and that those who have the opportunity will be induced to collect all the available information upon the subject which they can.

ART. IV.—*Harraday's Tailors' Cloth Cutting Machine.*

THE introduction of the sewing machine having commenced a revolution in the manufacture of garments, it seemed as if only one other invention was necessary to complete that revolution—the invention of a cutting machine, by which the cloth might be cut with a rapidity corresponding to that with which they were sewn. This desideratum appears to have been fulfilled by an invention of John Harraday, of New York, which is both simple and effective. The following figure represents this machine:—

Fig. 1.

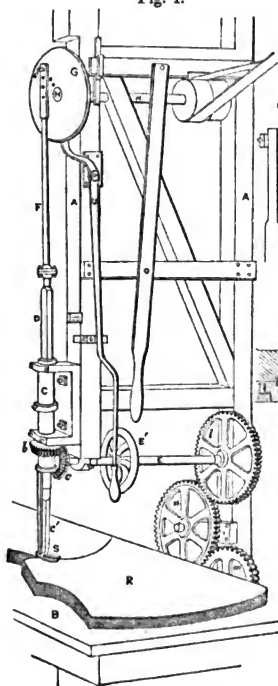


Fig. 2.

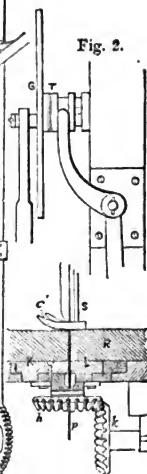


Fig. 3.

Upon a simple frame, *A A*, placed above a table, *B*, is secured a shaft, *H*, near the top, in proper bearings. This shaft is driven by a band from a steam engine, or the machine may be driven by hand. On one end of this shaft is a plate, *G*, which has a number of holes in it. In one of these holes is inserted a pin, *e*, which thus connects the rod, *F*, with the plate, *G*; therefore, as the shaft, *H*, revolves, the rod, *F*, will have a reciprocating up-and-down motion imparted to it, as the plate, *G*, thus acts the part of a crank, and the different holes in the plate and rod, *F*, serve to give different lengths of stroke to the knife, *c¹*, secured to the arm, *D*, which is allowed to move freely up and down in the hollow stock, *C*, but by a feather is moved round when desired, by turning the spindle, *E*, by the hand-wheel, *E¹*, which gives motion to the bevel pinions, *b c*. Behind the knife, *c¹*, and attached to the stock, is a bar which has a pronged foot, *S*, between the toes of which the knife *c¹* plays. This prong is to

keep the cloth, while undergoing cutting, from being lifted up by the action of the knife, and is therefore stationary. R represents a pile of cloth being cut into one side of a vest pattern.

The knife is of peculiar construction, and so is that portion of the table around which it plays. The lower end of the knife is a thin, narrow metal rod, *p* (fig. 3); it plays through a hole in the table, and down through the centre of the pinion, *h*, on the under side of table, B. The pinion is hollow, and has an opening for *p* to pass through it. J is a small circular plate or disk inserted into another rebate plate, I, in the table. [The left side of this plate is not distinctly shown in the figure]. The plate, J, is cast in one piece with pinion, *h*, and moves round with it. K is a small piece inserted at one side of plate, J, and secured with a screw, and answers for a cap.

It will easily be understood that when the cloth, R, say twenty plies of it, is laid upon the table, B, and the top piece chalked out for a certain piece of garment to be cut (all the pieces of the same size, like one side of a vest), that the reciprocating action of the knife will cut straight forward by pressing the cloth toward the knife; this action of the knife will be easily understood, but when an angle is to be formed, a sharp corner to be turned, how is this to be done? Simply by turning round the disk plate, J, in the table, and the knife, *c*¹, simultaneously, to cut on the new line. By turning the hand-wheel, E¹, the wheels, *l*, *n*, *m*, turn the spindle, K, which turns pinion, *h*, and the plate, J, and at the same time the spindle, E, moves the pinions *c* *b*, which turns the cutting knife, *c*¹, and the hold-down, S, all together. It is also necessary that the knife should turn in the smallest possible space, like a point. This is done by the knife being held up stationary while it is being turned above the cloth, and only the narrow thin guide rod, *p*, suffered to turn the cloth. The knife therefore is arrested and held suspended at the highest point of the stroke by a peculiar spring-brake in the part above crank plate, G; a pin being inserted into the periphery of said plate, which is caught between projections of the brake. [These are not shown in the figure, but are important devices for the perfect action of the machine.] U is the clutch lever for throwing the clutch collar and plate, G T, in and out of gear with the driving shaft, H. It is placed conveniently for the operator, so as to throw the cutting rod out of gear and motion instantaneously.

In the slot in the plate, J, through which the cutting knife plays, there is a metal edge at the one side (bearing against the knife), and a small flat spring on the other side; these prevent the cloth from being pushed or dragged down by the knife while cutting. By having the number of plies of cloth, R, set on the table as we have described, and as shown, twenty or more similar pieces for different garments, vests, or pants, &c., can be cut out at one operation. With this machine the inventor, Mr. Harraday, who is a practical tailor, can cut out 500 pairs of pantaloons in one day, and with more practice he has no doubt of being able to cut 1000 pairs in the same time. The advantage of this machine lies in cutting so many pieces of the same pattern at one time; it can cut on any line, straight or curved, and is altogether a most useful and ingenious machine.—*Scientific American*, July 22.

ART. V.—*Resumé of Researches on the Resistance offered by Hydraulic Limes and Cements to the Destructive Action of Sea Water.* By MM. MALAGUTI and DUROCHER. (Comptes Rendus de l'Académie des Sciences, 24th July, 1854.)

For several years past the attention of scientific men and of engineers has been occupied with the question of the destructive action exercised by sea water upon hydraulic mortars. M. Vicat, in seeking to explain this disastrous phenomenon, has shown that the sea water acts by its tendency to dissolve the lime of the mortars, which is then replaced by magnesia; but hitherto no efficacious means have been pointed out to prevent or neutralize this dissolving influence. We only know, in general, that the strongest hydraulic mortars, the cements or mixtures of lime and puzzolanas, which have set the most rapidly, are those which appear to best resist these causes of decomposition. Nevertheless, even amongst mortars and cements which set with equal rapidity, and are of nearly equal strength, it will be found that some possess very different powers of resistance, without its being possible *a priori* to distinguish, either by analysis or a quick trial, those on the stability of which complete confidence may be reposed.

In this state of uncertainty, we thought that, by the study of the cements which resist the decomposing action of sea water, conjointly with analyses of the hydraulic limes and cements incapable of withstanding its action, as well as of the products of the resulting decomposition, it might be possible to throw some light upon this question, whose difficulty is equal to its importance.

The samples, 16 in number, upon which we experimented, were the hydraulic limes of Paviers and of Doué, and the mortars made from them, Boulogne, Portland, Pouilly, Vassy, and Parker's cements. We are indebted for them to the kindness of those skilful engineers of the *Ponts et Chaussées*, MM. Jebuvier, Watier, and Bellanger, to whom we desire to express our thanks.

The mode which we have followed in our researches consisted in examining the modifications which were produced in the proportions of the different elements, in comparing the compositions of the substances plunged in sea water, with that of similar substances which were not immersed. But as we had no samples of mortars of lime and sand which had set under fresh water, to compare with those immersed in sea water, the examination of the latter could only be made by comparing their composition with that of the lime employed in their preparation. In these comparisons we had to deduct the sand, and to reduce the compositions found for the mortar, to those which they would have had if no sand had been used. We shall not detail here all the results which the discussion of our analyses revealed to us, and which are recorded in our complete memoir; we shall merely direct attention to the most prominent ones, which prove how complicated these phenomena of decomposition are.

Two cylinders of the hydraulic lime of Paviers were immersed, under similar conditions, in sea water during eighteen months. One of them lost

an enormous quantity of lime and gained very little magnesia; but to compensate for this, it fixed a quantity of carbonic acid almost sufficient to saturate the two earthy bases. An appreciable quantity of silicic acid was carried off with a little alumina. It appeared that a hydrated silicate of alumina was separated from the mortar at the same time with the lime, whilst carbonic acid was substituted for the constituents which disappeared. The alteration of the other cylinder was not so considerable; the loss in lime, and the gain in carbonic acid, were not so great; but, on the other hand, the quantity of magnesia substituted for the lime was double, and a little more silicate of alumina was abstracted. The same phenomena were observed with a mortar made with this lime.

Two prisms of this mortar were immersed during eighteen months in sea water. One of these prisms had no appearance of a well-marked alteration, whilst the second was in a very advanced stage of decomposition. It was found that some lime had, nevertheless, been eliminated, that a considerable proportion of carbonic acid had been fixed, and that the proportions of magnesia, silica, and alumina, had not undergone an appreciable change. The prism in which the alteration was considerably advanced had undergone a true transformation in respect to its composition. A considerable quantity of lime was replaced by more than an equivalent quantity of magnesia, and the carbonic acid had not sensibly changed; on the other hand, the silica and alumina had appreciably augmented.

Are we to seek for an explanation of these so different results in the non-homogeneity of the hydraulic lime which had served to make the experiments? We may remark that, in the deposit of Paviers, the different beds of hydraulic limestone have not the same composition. The alteration which the mortar produced from the lime of Doué underwent, consisted in the loss of a considerable quantity of lime, without the substitution of magnesia, and by the fixation of a great quantity of carbonic acid.

With regard to the alterations of cements, that of Boulogne, previously moistened with fresh water, began to crack after an immersion of eight months in sea water; nevertheless, its chemical composition did not sensibly change. It was quite different with Portland cement, which cracked in every direction under the action of sea water, fixed as much carbonic acid as it contained in its normal state, and, finally, it had lost a little lime, which was substituted by a very small quantity of magnesia. Lastly, a mortar prepared with one volume of Portland cement, and two volumes of quartzose sand, immersed during a year in sea water, exhibited no trace of alteration, unless it gained some carbonic acid.

In fine, the facts which we have brought forward, and all those which are detailed in our memoir, prove that the decomposition of limes, cements, and mortars by sea water, do not constantly take place in the same manner; the substitution of magnesia for lime takes place sometimes, but not always, and as it is accompanied by the addition of carbonic acid, the altered mortar consists of a hydro-silicate of alumina, and of a double carbonate, which tends to approach dolomite in composition. But there are cases where the lime disappears without the introduction of magnesia, and

the phenomena appears then to occur as if it had been produced in water free from salt, but charged with carbonic acid. Further, in the alteration effected in mortars moderately hydraulic, there is a division of the constituents of the mortar into two compounds, the one rich in earthy carbonates, the other rich in alumina, coming to the surface and forming a snowy deposit, which the waves remove. This partition is not effected, or at least it only takes place very slowly, in the very hard and rapidly setting cements or mortars. The alteration which is produced in the latter consists in a simple cracking of the mass, and in the disappearance of a small quantity of lime, with or without its being substituted by magnesia, and in both cases there is a tendency to diminish in volume, whence results the cracking of the mass.

It only remains for us to speak of those cements which are considered to best withstand the action of sea water. Hitherto the cements of Pouilly, Vassy, and Parker have been looked upon as the most stable. A circumstance struck us in the analysis of these three cements: it is, that they are very rich in oxide of iron, and that that of Parker, which is the best resisting, is exactly the richest. We have, in fact, found 7 per cent. of oxide of iron in the cements of Pouilly and Vassy, and nearly 14 per cent. in that of Parker. Hence we have been led to consider whether the presence of oxide of iron does not powerfully contribute to give to those cements the property of resisting the decomposing influence of sea water. In order to justify this opinion, it became necessary to institute experimental researches, by making ferruginous cements and exposing them to the action of sea water. But before doing so, we had to ascertain whether oxide of iron contained in cements and mortars did not behave as an inert substance. Thus we had to examine how far this oxide was capable of forming, in the humid way, combinations with lime. With this object in view we formed directly kinds of puzzolanas, by making mixtures of silica and a little lime with alumina and oxide of iron, and then studied the action of lime water on these mixtures, previously heated to a dull redness. After immersion for some time these substances augmented in volume, and possessed the most remarkable characters. Each of them divided itself into two distinct compounds, one of which attached itself to the bottom of the flask, and had gained considerable cohesion and adherence; whilst the other assumed a flocculent aspect; it swelled out more and more, and rose to about 15 or 16 centimetres above the bottom. In analysing these different compounds, we have found that the quantity of lime precipitated is independent of the presence of alumina, whilst it is augmented by the presence of oxide of iron. Further, we have recognised that the flocculent compound was the richest in alumina, and that the concreted deposit was richest in oxide of iron.

These synthetical experiments having apparently demonstrated that oxide of iron is not an inert constituent of hydraulic cements, we believe that we may conclude that the presence of this oxide would contribute to give stability to mortars and cements immersed in sea water. It remains, in fact, to be ascertained whether cements or artificial hydraulic limes, formed by the addition of lime to ferruginous clays, or mixtures of clay

with hydrated peroxide of iron, or even mixtures of clay and substances capable of generating oxide of iron, will not be attacked by sea water. But these experiments require a considerable time, and in the meantime it may be useful to give publicity to the results which we have obtained, as they may be useful to those engaged in the construction of hydraulic works, and further, because it is of the greatest importance that they should be verified by experience. Whatever may be the future value which the test of experience may reserve to our inductions, two facts have at all events been well established:

1. Those cements which are reported as the best for resisting the destructive action of sea water always contain a notable quantity of peroxide of iron.
2. Certain combinations of silica, alumina, and lime, give, under otherwise similar conditions, very different reactions, according as they are deficient in, or contain large quantities of oxide of iron.

ART. VI.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

MINING, METALLURGY, ETC.

Montigny's Chronometrical Anemometer for currents of Air in the Galleries of Mines.—The Society of Sciences, Arts, and Literature of Hainault, lately proposed the following subject of inquiry:—"To discover an exact method of registering continuously, or at intervals extremely short, the velocity of air, especially in the shaft or gallery of a mine, during at least twelve consecutive hours." Professor Montigny, of Namur, has accordingly produced an instrument intended to fulfil these conditions. It consists chiefly of a clock indicating the hour, minute, and second. The pendulum is about one metre in length, and the whole is placed in an airtight box. The axis of rotation of the pendulum is prolonged beyond the box, and has attached to it a lever at right angles to the pendulum. At the extremity of this lever is a flat rectangular disk, perpendicular to the lever, and consequently parallel to the pendulum rod. A counterpoise is attached to the axis within the box, so as to enable the whole apparatus to be in equilibrium, when not subjected to the action of currents. When the pendulum is vertical, the lever carrying the disk is horizontal, from which position it deviates more or less proportionally to the arcs of oscillation of the pendulum.

In order to ascertain the normal working condition of the instrument, it is first set going in still air, and its rate is compared to that of a chronometer, care being taken to adjust the different mechanical arrangements, so as ultimately to establish an exact synchronism between the anemometer and the chronometer.

This being effected, the instrument may be placed in a horizontal current, with the flat disk perpendicular to the direction of the current. The pressure thus received by the disk will evidently be transmitted to the pendulum, and will thus tend to diminish the time of each oscillation. This follows because the entire pressure on the disk can be decomposed into two, one tangent to the arc described by the centre of the disk, the other in the direction of the lever. The tangential force tends to render the lever horizontal, consequently the pendulum, vertical, and it is thus an additional force added to those which, in the normal condition of

a pendulum, always tend to bring it into a vertical position. After a certain time, the anemometer must show a sensible advance in comparison to the chronometer, by which it was originally set.

The relation between the advance, a , of the anemometer over the chronometer, after a certain time, t , during which the velocity, v , of the current is for simplicity supposed constant, will be given by the formula,

$$V = q \sqrt{\left(2 \frac{a}{t} + \frac{a^2}{t^2}\right)} = q \frac{a}{t} \sqrt{\left(1 + 2 \frac{t}{a}\right)}$$

if it be admitted that for velocities less than 10 metres, [32 feet 9 inches,] the pressure of a current of air against the plate, and perpendicular to its direction, is proportional to the square of the velocity. q is a numerical co-efficient depending on the area of the disk, the length of the lever, the weight of the oscillating part of the apparatus, and on the tension and temperature of the air. By the aid of this formula a table has been calculated, showing the velocity of a current of air corresponding to an advance of from one to five seconds, during periods ranging from five minutes to half-an-hour.

This anemometer seems to be founded on a principle in some respects new, and to present an advantage not always found in those generally in use, namely, of being immediately affected by any sudden change in the velocity of the air. It certainly possesses this advantage, when compared to the wind vane rotating anemometers, which, after receiving a certain velocity from the impressed forces, cannot readily lose their momentum, and change their motions when the forces have lessened. It is recommended that, when used in a mine, this anemometer should be placed in a niche, hollowed in the sides of the shaft or gallery, so that nothing would be left exposed except the disk. If the gallery should not be horizontal, the disk should be suitably inclined; if the instrument is placed in a vertical shaft, the disk should be placed in a horizontal position, and as a general rule, the plane of the disk should be perpendicular to the axis of the air passage, in which the anemometer is to work.

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

Luttgens' new differential Governor for Steam Engines—The exertions which engineers have been recently making, in order to produce greater uniformity in the action of steam engines, is a natural result of the delicate and important applications to which steam-power is now applied. For this object, several ingenious methods have been devised, some entirely dispensing with the original governor invented by Watt and others, rather improving its application, so as to render its action more continuous and regular. This seems to be the nature of the improvement proposed by M. Luttgens of New York, of which we present a brief notice. In this regulating apparatus, the connecting rod of the stop for shutting off steam, is set going by an eccentric, which is capable of varying its eccentricity according to the action of the governor.

The regulating portion of this apparatus is applied to the principal axis, which is turned by the main crank. On this principal axle a pulley is fixed, over which a strap passes, that embraces another, which is fastened on a small axle placed above, and parallel to the principal axle. The small axle has a bevel wheel which moves on another fixed to the vertical rod of a conical pendulum, this rod turning in a socket and collar fixed on the framework, which also supports the gudgeons in which the axle turns. Lastly, a pulley of greater diameter than the first is attached to the small axle, and from which proceeds a strap, that sets the whole regulating machinery in motion.

With the ordinary governor, when the velocity changes, the balls rise or fall, thus closing or opening the throttle valve. The motion of the engine is thus brought back to its normal state; but the balls return very soon to their former position, and the advantage is thus only temporary. This defect seems to be absent in the arrangement of M. Luttgens, because the adjustment of the eccentric to a variation of velocity does not cease until the balls have occupied their proper position in a gradual and continuous manner.

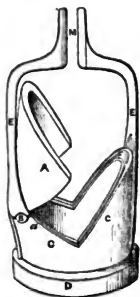
Improved Windmill.—Daniel Halladay, of Ellington, Connecticut, claims an improvement in windmills. This consists in the attachment of wings or sails to rotary movable spindles furnished with levers; these levers are also attached to a head which rotates with the sails upon the same shaft. Another lever is attached to the head. This is connected to a governor which slides the head upon the shaft, so as to cause the lever to turn the wings or sails. The necessary resisting surface being thus presented to the wind, a uniformity of velocity is attained. The proper regulation of the obliquity of the sails, so as to adapt them to the varying motive force of the atmosphere, is represented by the inventor to be thus secured, without difficulty, to a degree which renders his mill more constantly available than those hitherto employed.—*Scientific American*, July 29th.

Improved Stone-dressing Machine.—Mr. Charles T. Porter, of New York, has taken out a patent in these countries, for an improvement in machinery for dressing stone, from the use of which certain advantages are promised to those engaged in that important and extensive business. In a late invention the adjustment of the ways at the desired angles and the maintenance of the proper relations between the rest, the hammer, and the toolstock, are provided for by the employment of a cylindrical rest, and further by giving a concavity to the toolstock whereby it is fitted to the cylinder and pivoting the ways to the rest. Mr. Porter professes to have rendered this cylindrical arrangement unnecessary, thereby simplifying the desired process and lessening the cost of machinery, and to have attained other desirable ends. Among these he specifies the accomplishment of a more rigid connection between the ways and the rest, whereby much racking and disarrangement is obviated. The rest and ways, which constitute a sort of frame, are furnished with journals fitting to suitable boxes in the main framing, and these journals serve as pivots upon which the rests and the ways swing together in such a manner as allows of their adjustment as the altered motion of the hammer requires from time to time, in order to secure the desired angle of cut or dressing.—*Scientific American*, July 29th.

Music Printing Press.—The printing of pieces of music from plates has hitherto been performed like all copperplate printing by hand. That is, the ink is first rubbed on the plate by a roller, then wiped off by a cloth, so as to remove all the ink from the surface, and leaving only the cavities of the plate filled. James F. Starret, of New York, has invented a press for printing music by power. The plate is wiped by a revolving cloth, and the bed for carrying it round under the impressing cylinder, although secured to a central rotary shaft, is so arranged as to carry the plate in a straight line, while the impression is being made. The receiving table has a peculiar motion; it rises and falls with the weight of the copies received, and vibrates so as to receive the little page copies at one side, then comes round and receives the printed music on the other side. The press is very ingeniously constructed, and calculated to save an immense amount of labour.—*Scientific American*.

Dodge's Pump Valve.—The annexed engraving represents an improvement in pump valves, the invention of Nehemiah Dodge, of New York, which appears to possess considerable merit, especially for use on shipboard, where it is of the greatest importance to have pumps which can be relied upon in an emergency.

The upper part of the valve A is arched and hinged at B; consequently, when the valve is open, as shown in the cut, the liquid presses upwards without any obstruction whatever. When the valve A falls, it shuts upon F, rendering leakage almost impossible. The edges F are lined with India rubber or other suitable packing substance. It is a well known fact that the centres of liquids passing through conduits or pipes, have a greater velocity than their outer surfaces, and that any projection which interrupts the free course of the moving liquid, forms an eddy which is likely to retain foreign substances. Pumps furnished with the valves here shown are free from such objections.



In common ship pumps, where clapper valves are employed, that portion of the pipe in which the piston moves, is made larger than the supply pipe. A vacuum is thus produced in a chamber of larger dimensions than the diameter of the supply pipe. It is found in ordinary practice, that if the piston is suddenly raised, the water, owing to the contraction of the supply pipe, cannot rush in to fill the vacuum fast enough to keep pace with the ascending piston; consequently there is a return pull or tendency in the piston to fly back. Sailors are sensible of this; and so, in pumping vessels, they have a habit of holding down the break for a moment at the end of each stroke; they say it brings more water. This is true. By holding down the break, the water has time to rush up and fill the vacuum, which would be destroyed were the piston allowed to return. Evidently there is a loss of power, or what is equivalent, of time, which could not exist to so great a degree if the pump pipe were of uniform dimensions throughout. By using Mr. Dodge's valve, the supply pipe may be enlarged to the same dimensions as that in which the piston moves; the water will, therefore, fill the vacuum about as fast as formed, and there will be little or no pull back on the break.—*New York Peoples' Journal*, June, 1854.

Loysel's Hydrostatic Percolator.—M. Loysel has designed a very simple and ingenious apparatus for extracting colouring matters from dye woods, and also for obtaining infusions or extracts of vegetable substances for medicinal or other purposes. The principle upon which it is constructed is that of direct hydrostatic pressure applied by a simple and inexpensive apparatus. The substance to be operated upon is placed within a cylinder whose bottom is finely perforated; a similar pierced diaphragm is then placed over it, so as not to produce any pressure; the liquid, either hot or cold, as may be required, is poured into an upper reservoir, whence it descends by a centre tube to beneath the lower diaphragm, and is forced upwards by the pressure through the substance, every particle of which it saturates in its passage, expelling the air and carrying before it the finest portions to the upper strata against the underside of the upper diaphragm. When a sufficient quantity of liquid has passed, or the infusion is completed, a cock is opened which permits the infusion to return from above by its own specific gravity through the substance already operated upon, thus completing the abstraction of any colouring or other matter not previously taken up, and at the same time filtering the liquid. By a second and similar process anything still remaining in the substance could be extracted.

It is practicable by varying the height of the column to give any degree of pressure, and by the application of a lamp, or in a large apparatus, of a coke fire, the temperature of the decoction could be maintained as might be desirable. By another modification the steam generated in a small boiler can be made to regulate the action of the apparatus.

This system is described as being adapted to a great many purposes, and possesses the merits of great simplicity, of facility of management, and of being easily cleaned, and of producing a perfect infusion of the substance. A coffee extractor of this construction adapted for a large establishment, is said to have produced four gallons of coffee in twenty minutes. [It strikes us as being peculiarly adapted to prepare decoctions of bark for tanning purposes.]—*Proceedings of British Institution of Civil Engineers, through Artizan for May, 1854*.

Cutting Tenons on Spokes.—R. L. Tibbet, of Shippensburg, Pennsylvania, has applied for a patent for an improved mode of cutting tenons on the hub ends of spokes. The nature of the invention consists in securing in a peculiar manner a series of spokes within a frame and so adjusting them by keys and set screws that a plane of proper construction run over the ends of the spokes cuts the proper tenons thereon.—*Scientific American*, August 5th.

Spark Arrestors.—C. Abos, of New Brunswick, N.J., has obtained a patent for spark arrestors to locomotives, whereby the sparks are prevented from passing out, and are returned back to the fire-box. This is effected by a peculiar arrangement of the draught pipe, and by the introduction of a central spark-conducting or return pipe provided with a self-closing valve.—*Scientific American*, No. 41, June 24.

How's Engine-room Telegraph.—The absurd and dangerous methods generally employed for transmitting commands from the captains of steam-vessels to the engineers, have not as yet been superseded by a more rational practice, and any such attempt as the present will consequently be regarded with some interest. The principle of this apparatus is merely that of communicating by very simple gearing, consisting of a vertical shaft and some wheel-work between a dial on the captain's gangway and another corresponding dial, furnished with an alarm bell, and placed in a conspicuous part of the engine-room. Every turn of the captain's dial will cause the bell to strike, and thus call the attention of the engineer to the particular signal. The engine-room dial is covered with a case, in which is an aperture large enough to allow only one signal at a time to be seen. Whenever the captain wishes to give directions to the engineer, he moves his dial until he brings round the required signal, the bell strikes, and the engineer, looking up, sees the words of command through the aperture of the engine-room dial.—*Artizan for July.*

Life Preserver Seat.—Some very successful experiments are reported to have been made at the Navy-yard, in Washington, upon a life preserving seat, invented by Mr. N. Thompson. This seat forms a ship stool of the usual size, convenient, neat, and substantial, and can be converted into a life preserver in a moment, by moving two brass slides, which allow it to divide and open, and then by moving the slide a few inches more, they hold it firmly in that position. It then forms a strong frame, with a capacious air chamber at each end, and the person is supported in the water without effort, the sides coming up under the arm pits, and leaving the arms and legs free. An experimenter, who had never before seen the apparatus, threw himself, with it, into 18 feet water, and managed it in many ways with perfect ease.—*Scientific American*, No. 43, July 8th.

MANUFACTURES FROM MINERAL SUBSTANCES.

Norton and Borie's Tubular Tiles.—A new kind of roofing tile, made on the same principle as the hollow bricks, is now being made. Each tile has four tubes running through it, the effect of which is to effectually prevent the heat of the sun from overwarming the interior of the building, as air is an exceedingly bad conductor of heat. Each tile is locked to the next by means of a kind of groove and flange, so that it is impossible for the wind or air to blow through, as is often the case with slates. The tubular structure, at the same time that it renders the tile very light, makes it much stronger.—*See Artizan for May.*

IMPROVEMENTS AND INVENTIONS CONNECTED WITH CHEMICAL PROCESSES.

Determination of the percentage of Tannin in substances used for Tanning. By Professor Fehling.—[In an article published in No. V., page 143, of this Journal, "On the means of determining the nature of the Colouring Material employed to dye any particular fabric," we intimated our intention of bringing under the notice of our readers from time to time, such processes as may be proposed for determining the quality of the different substances used in manufactures. This promise we shall endeavour to redeem in future, and accordingly commence with the following process for the determination of tannin in barks and other tanning materials. There is perhaps no branch of manufacture in which the aid that chemical analysis can give is so little availed of, as that of leather, and yet there are few perhaps in which so much good might be derived from it. The value of a tanning material depends altogether upon the amount of tannin which it contains, and yet how many tanners ever think of ascertaining the amount present, or how many know when they have exhausted their bark of what it contains?] Among the various substances which precipitate tannin from solution, such as gelatin, quinine, animal skin, &c., the latter has hitherto been recommended as the most appropriate for determining the percentage of tannin. This method of valuation has been preferred because it represents in miniature the operation to which the results refer. There are, however, no detailed directions for its application, and in repeated trials made by the author, under a variety of conditions, he has found that the tannin is never perfectly precipitated, and that the solutions soon become

mouldy. Experiments with a solution of quinine, freshly precipitated oxide of iron or alumina, did not give more satisfactory results. He then tried gelatin in solution, and instead of weighing the precipitate obtained, by adding an excess of gelatin, preferred adopting the volumetrical method, estimating the quantity of solution of gelatin of known centigrade value required to precipitate the tannin. For this purpose it is indispensable that the precipitate should separate readily, but with most kinds of tannin this is not the case. The author has found it advantageous to use a dilute solution of gelatin, and to have the liquids quite cold. His mode of operating is as follows:—

The solution of gelatin is prepared by digesting ten grm. of dry gelatin (containing about eighteen or nineteen per cent. of water) in water for twelve hours, and then applying heat until the solution is complete. The volume is then made up to one litre.

For the purpose of determining the centigrade value of the gelatin solution, 0.2 grm. of pure gallo-tannic acid dried at 212° F. is dissolved in 100 or 120 grm. of water, and the gelatin solution added from a graduated burette until the precipitation is complete. Filtration is generally necessary towards the end of the operation, or as a substitute, the following plan may be adopted: A narrow open glass tube is covered at one end with some tolerably thick linen bound tight by cord; on immersing this covered end into the liquid, and sucking out the air by the mouth at the other end, a portion is rendered clear by passing through the linen and may be poured into a tube, and tested with gelatin.

The author found that the 0.2 grm. of pure dry tanno-gallic acid required from 32.5 to 33 cub. cent. of the gelatin solution for perfect precipitation; when the gelatin solution is some days old, a larger quantity is necessary, 35, 38, or even 40 cub. cent. It is therefore necessary in all cases, when the gelatin solution has been kept any time, to determine its centigrade value by means of gallo-tannic acid immediately before making any experiments with it.

If it is required to estimate the value of oak or other barks for tanning, they are first dried in a warm room, powdered finely, digested in quantities of 10 grms. with warm water, and exhausted by means of a displacement apparatus constructed of a tube two feet long, one inch wide, and drawn out at the lower end, which is loosely stopped with cotton wool. Some substances may be introduced dry into this apparatus, and exhausted by warm or cold water. The extraction may likewise be facilitated by the pressure of a column of water applied by fitting a narrow glass tube with a cork into the upper end.

In most cases, the extraction is completed in one or two days. When the operation is properly conducted, the quantity of liquid extract amounts to half a pound or a pound. It is then treated with gelatin solution so long as a precipitate is produced. A few drops of dilute hydrochloric acid facilitate the separation of the coagulum.

The quantity to be taken for an experiment of substances rich in tannin, such as galls, is about 0.5 or 1.0 grm. A simple calculation gives the percentage of tannin.

The author states that he has adopted this method in repeated examinations of tanning materials during the last ten years; he has found the results tolerably constant, and notwithstanding its apparent imperfection, more trustworthy than any other yet known.

He estimates the relative value of several substances of this kind as follows:—

Pine bark.....	contains from	5 to 7	per cent. tannin.
Old oak bark.....	"	9	" "
Best oak bark.....	"	19 to 21	" "
Gall nuts.....	"	30 to 33	" "
Alleppo galls.....	"	60 to 66	" "
Chinese galls.....	"	70	" "

These data at least admit of comparison with each other, and indicate with tolerable certainty the respective value of these substances to the tanner. This method of valuation is indeed based upon the assumption that the same kind of tannin exists in all these substances. It is, however, extremely probable that this is not the case, but at the same time it may fairly be assumed that if different kinds of tannin combine under similar conditions with different quantities of gelatin, they will also combine with animal skins in the same relative proportions. If, therefore,

this method does not indicate the absolute percentage of tannin, it still gives the percentage value of the substance examined, and it is precisely this which the tanner requires.

It is another question whether gelatin solution precipitates all the substances of the tanning material which combine with the skin, and it therefore remains to be determined by experience whether such a method of valuation is sufficient for the purposes of the tanner.—*Polytechnisches Central Blatt*, 1853.

A new solvent for Collodion.—MM. E. Mathew Plessy and Iwan Schlumberger have proposed wood spirit, or methylic alcohol, as a substitute for ether for dissolving collodion. For this purpose it has many advantages; as it is not so volatile as ether, a thicker and more uniform coat can be applied on glass for photographic purposes. The solution of collodion thus prepared is capable of dissolving a much larger quantity of iodide of potassium than an ethereal solution, and will consequently yield a more sensitive coating. The only inconvenience attending the use of wood spirit, and which it is important to notice, is, that during its slow evaporation from the surface of glass, &c., a certain quantity of formic acid is produced. By adding a little alcohol of sp. gr. 40° to the wood spirit and gently warming the glass plate upon which the coating is to be put, the formation of the acid may be obviated. The low price of wood spirit will, we are sure, induce many photographers to test the matter.—*Bulletin de la Société Industrielle de Mulhouse*, No. 212, p. 187.

IMPROVEMENTS IN THE MANUFACTURE OF TEXTILE FABRICS.

Improved Roving Tube.—In this machine, as usually made, an eye is placed in front of the tube proper, for the purpose of twisting the sliver and forming the roving. Edmund W. Dean, of New London, Connecticut, has made an improvement, in which he proposes to substitute for the usual eye, a "variable elastic mouth-piece;" this is made to take hold on the sliver sufficiently tight to insure the requisite twist. Needless friction is thus avoided, and two other advantages gained, according to Mr. Dean's specification, viz.:—the exact regulation of the condensation of the roving, and greater facility in repairing, should a break occur while the tube is in motion.—*Scientific American*, No. 43, July 8th.

American Artificial Leather.—About a year since a kind of material known as American leather cloth appeared in commerce. This substance has lately attracted considerable attention at the fair of Leipzig, and is now being much employed by saddlers, writing-desk and pocket-book makers, upholsterers, and even by shoemakers. It may be obtained of any colour, and resembles in many respects wax-cloth, but in some particulars it differs widely from that material, as it appears that leather cloth is not attacked by hot water, acids and saline solutions, alcohol and volatile oils, sulphuric ether being the only substance which is capable of attacking it to any extent. It may be strained in every direction without the coating tearing, cracking, or scaling off. These properties would lead to the supposition that gutta serena or caoutchouc was employed in its manufacture; this, however, seems not to be the case, in the opinion of judges, as well as from the low price of the article. The names of the American manufacturers are J. R. and C. P. Crockett. Already, however, attempts have been made to imitate it in Germany. [A cloth of this character, and admirably adapted for upholstery purposes, was exhibited at the Dublin exhibition by D. J. Honldsworth & Co., Portland-street Mills, Manchester, but whether made in imitation of the American we cannot say.]—*Deutsche Gewerbezeitung*, 1854, s. 164.

Printed Leather.—M. Pigalle, of Paris, has invented a process, by which he is enabled to print the most varied patterns in colours, upon leather destined for upholstering furniture and for lining carriages, as well as for the preparation of garments of different kinds. The chief difficulty experienced in the dyeing of skins is the removal of fatty matters, which prevents the absorption of the mordant and of the colouring matter. That difficulty has not hitherto been successfully overcome, and hence the want of solidity and uniformity in the colours of dyed skins, and the kind of marbled appearance which they present, and which spoils their effect.

M. Pigalle considers that he has discovered the means of purging his skins completely of all fat; but although his results, judged by his products, are better than those obtained by others, there is still wide room for improvement. Perhaps he may further improve his process, which is still secret.—*Bulletin de la Société d'Encouragement*, No. 6, March, 1854, p. 184.

PROCESSES CONNECTED WITH RURAL ECONOMY AND AGRICULTURE.

Fish Manure.—M. Molon, of Concarneau, in the Department of Finistère, has addressed a note to the French Academy of Sciences on the subject of fish manure, which it appears he has been in the habit of preparing during the last two years. The process which he adopts to prepare the manure consists in placing the fish in a pan with a double bottom, heated by high pressure steam. When sufficiently disintegrated by the action of heat, the mass is allowed to drain, so that the oil and juices may flow away, and is then pressed in sacks in the ordinary way. The pressed cake is reduced to a coarse powder by a rasp; the powder, placed in thin layers upon cloths stretched upon frames, is then thoroughly dried in a particular kind of stove by means of a current of warm air, and perfectly ground in a mill. In this condition it may be at once employed as a manure, or preserved during any length of time. M. Molon states that after an experience of two years, with considerable quantities of this manure sold to agriculturists, he has invariably observed that its manuring value was superior to that of Peruvian guano. The sum realized by the sale of the fish oil enables the manure to be sold at a moderate price.

The process just described scarcely differs from that patented last year in these countries, and which we brought under the notice of our readers in the first number of this journal. Some person ought to try the experiment on our coasts of making a manure of this kind.

Granaries for the Storing of Corn, by the Brothers Huart, of Cambrai.—The Messrs. Huart, the great millers of Cambrai, have patented a peculiar kind of granary which they have in use for the storing of their corn. In this arrangement the corn fills completely the space in which it is to be preserved, and is kept in constant motion by means of a steam-engine. The grain is lifted up and stirred round by means of a helix, and from thence falls upon an apparatus in which, by means of a fan, the chaff-dust and other foreign substances are removed, and the insects and their larvæ destroyed. The corn is then carried back to the same inclosed space again, and the operation from time to time repeated. These granaries are considered to be adapted not only for the preservation of corn in good condition, but for that which is already damaged.—*Le Génie Industriel*, Nov. 1853, p. 237.

ART. VII.—*Bulletin of Industrial Statistics.*

CLASSIFICATION OF MANUFACTURES.

THE importance of statistics being now universally admitted, the question naturally arises as to how and in what manner they can be best collected. Hitherto the statistics collected in these countries were very defective, but especially in classification, without which, statistics are worse than useless. We are glad to perceive that this subject is receiving attention, and that the Board of Trade are willing to adopt a better system of classification. A communication to that effect having been made, among other bodies, to the Leeds Chamber of Commerce, that body decided to recommend the following system for woollen goods:—

1. Broad woollen cloths, all wool, or mixed with other material, stating yards and value.
2. Woollen cloths, heavy, viz., flushings, pilots, beavers, petershams, whineys, and Devons, whether all wool or mixed, yards and value.
3. Woollen cloths, cloaking, coatings, &c., yards and value.

4. Narrow woollens, viz., trowserings of all descriptions, whether all wool or mixed, yards and value.
5. Woollens, waistcoatings made of wool, mixed, yards and value.
6. Flannels and baizes, yards and value.
7. Carpets, all wool or mixed, yards and value.
8. Druggets, all wool or mixed, yards and value.
9. Blankets, pairs and value.
10. Blanketing, yards and value.
11. Shawls, woollen or mixed, number and value.
12. Woollens not enumerated, including ready made cloths, dozens and value.
13. Woollen yarn, pounds and value.

This system of classification is a most decided advance upon that heretofore adopted, but it might be still further improved; for instance, we think that "all wool" goods ought to be specified separately, and the different materials employed in the mixed goods indicated. We hope that the proposal will be accepted, by all other Chambers of Commerce, and that a good system may be finally eliminated.

HARDWARE TRADE OF THE UNITED STATES.

The *United States Economist* (quoted in the *Scientific American*,) has the following curious remarks upon the hardware manufacture of America:—"The manufacture of many articles of hardware has lately been introduced into this country, and firmly established. This has, in fact, been constantly going on for many years. Forty years ago, not more than half a dozen leading articles of the trade were of our own manufacture; the rest were all imported; now by far the greater part of the trade is in articles made by our own artisans. The imported articles, too, are, one after another, yielding the palm of superiority to those of American manufacture. American enterprise, machinery, skill, and ingenuity, are more than a match for European fogynism. The English manufacturers aim at producing a cheap article, strong enough to avoid being blown to pieces by the wind; the American manufacturers aim at producing, and in nine cases out of ten succeed in producing an article as cheap as that imported, and possessing at the same time the qualities of simplicity, strength, and durability. This is especially the case with regard to light articles, such as door latches, locks, &c. Many of our heavy articles are unapproachable by the English imported goods. For instance, our Eagle anvil, with its cast-steel face, is firmer and more durable than the English anvil of wrought iron. The American chain vice is an improvement unknown there. The augurs made here are far in advance of the English ideas of progress, and so of many other articles. Five years ago, masons' trowels were all imported, now 30,000 dollars' worth of trowels, confessedly superior to the English, are made by one manufacturer, Mr. Bisbee, in South Canton, and his business doubles annually. Even the celebrated Congress penknives are now re-produced by our own workmen with all the elegance and excellence of the English knife, and we might extend the list indefinitely. Again, the American goods are generally warranted, an advantage not possessed in our home market by those which are imported.

"The exportation of American hardware has sprung up almost entirely within the last few years, and is rapidly becoming a very extensive business. Already have American goods found their way into the British Provinces, and are preferred to their own (English) home manufactures, thus competing successfully with English goods in their markets. The exportation to Canada, especially, is rapidly increasing, and almost doubles annually. The Duglass axes are sold even in London. Large quantities of goods are also sent to the West Indies, South America, and to all parts of the world."

BOOT AND SHOE TRADE OF MASSACHUSETTS, UNITED STATES.

According to the *Boston Atlas*, nearly two pairs of shoes are made annually for every inhabitant of the United States, or in other words, the enormous number of 48,000,000 of pairs.—*Scientific American*, July 8th, 1854.

THE

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ART. I.—*Notes on the Inland Navigation of Ireland.* Part II. By
HENRY HENNESSY, M.R.I.A.

WE have seen the great natural advantages which the physical structure of Ireland presents for inland navigation, and we have also been able to form some notions as to the way in which these advantages have been applied. Engineering works of great magnitude and solidity have been already executed, yet something still remains to be done in this department; but our observations in the present note will refer chiefly to the improvement in the locomotive arrangements of inland navigation, after a few remarks regarding the improvement of the principal water-ways.

Of these the first which demands notice is the Shannon, both as an independent line from Lough Allen to the sea, and as an important part of the great diametral line extending from Limerick to Coleraine. The condition of this noble river, as already pointed out, is such, that now no very important improvement seems possible, except that of rendering the portion between Limerick and Killaloe navigable, in the same sense as that between Killaloe and Athlone. When the engineering difficulties already surmounted on this river are duly remembered, and when we recollect that several miles of the navigation between Limerick and Killaloe is through the stream, the practicability of such an undertaking will not appear so problematical as many seem to consider it. The construction of a sufficient number of locks of the same magnitude as that at Meelick, or 170 feet long by 40 feet broad within the chamber, seems to form one of the most considerable items of expense. The chief objection to locks with a high lift is the great loss of water during the passage of vessels, but this objection would be scarcely applicable to a series of locks supplied by Lough Derg. If, with Sir Robert Kane* and Mr. Mulvany, we assume the maximum discharge at Killaloe to be one million of cubic feet per minute, and the minimum in the driest summer weather at 100,000 cubic feet per

* Industrial Resources, 2nd ed. p. 82.

minute, and remember that an admirably constructed waste weir, 1,100 feet in length, now spans the river at this point, it will not require any calculation to be convinced that the supply would be almost inexhaustible for the purposes of navigation. Under these circumstances, the declivity of the river could be surmounted by a smaller number of the large locks than it is at present of the small locks. On the Leeds and Liverpool canal, where the supply of water is comparatively limited, five locks rise together 88 feet, thus giving each lock a lift of 17 feet 7 inches. If we allow to the current an average slope, somewhat less than 1 in 8,000, for the 15 miles between Limerick and Killaloe, the lift required to be surmounted by the locks will not exceed 88 feet. The recent construction of floating docks at Limerick, and other improvements in that port, makes its connexion with the Upper Shannon more important than ever. The completion of such works as are here referred to would enable sea-going screw steamers to traverse the greater part of the Shannon from its mouth upwards, and would thus establish a direct navigation between the central districts of Ireland, and the principal ports at the opposite side of the channel. In France and in Canada such tendencies of economising transport have been already manifested: the cost of breaking bulk and transshipment of cargoes having led, in the former instance, to the establishment of a screw line direct between London and Paris; and in the other to a very successful attempt to pass vessels of large tonnage over the rapids of the St. Laurence, thus opening a direct communication between some of the great central lakes of America and the port of Liverpool.

The connexion of Lough Erne with the Shannon by Lough Oughter was made the subject of a detailed Report by Mr. Mulvany in 1839. Although he does not seem to have contemplated the adoption of steam vessels on the artificial parts of the line, their introduction throughout might be effected by the use of the screw propeller, and the construction of locks sufficiently long. The moderate original estimate of £170,000 for the entire work, would thus be slightly increased, but if this line of navigation should ever be finished, it must evidently be something better than a canal for conveying ordinary barges.*

The connexion of the Shannon with Lough Neagh being thus established, a water communication would be open between the south and centre of Ireland and its north-east coast at Belfast and Newry; while a further opening could be made through the Lower Bann towards Coleraine. From the description already given of this river,† it is evident that it presents such a series of levels, regularly descending step-like to the sea, as would present facilities for the establishment of locks, and if suitably im-

* Since this paper was written we have learned that considerable progress has been made with this canal, which is to connect Lough Oughter with the Shannon, near the southern extremity of Lough Allen, at Drumshambo, passing through the town of Ballinamore. It also appears that Mr. Dargan has, or had, a steamer plying upon Lough Erne, between Enniskillen and Belturbet, thus giving to the former town the advantages of the Ulster Canal. We have not as yet been able to get any data as to the size of the locks, and cannot therefore say whether provision has been made for steam vessels.

† Last Number, p. 252.

proved, it would form a permanent line, adapted to vessels of sea going dimensions.

Some important improvements might be suggested in others of the possible lines of navigation, especially in the lines of the Connaught lakes, and in the southern Blackwater, but want of data induces me to defer any further remarks of this nature.

The locomotive question of inland navigation requires the solution of two fundamental problems. 1. What is the best shape and construction of vessels for carrying a large cargo with the least draught of water, and minimum expenditure of tractive or propelling force? 2. What is the kind of motive power best adapted to the requirements of inland navigation?

The greatest immersion with the least vertical depth is evidently secured when the immersed section is a rectangle, in other words, when the bottom and sides of the vessel are flat, and the latter perpendicular to the former. This, therefore, should be the normal section of vessels intended for shallow waters, from which only slight and indispensable deviations should be permitted. Such a shape, combined with lightness of materials and general structure, would entail only a very small draught of water. The principal difficulty consists in combining these conditions with such lines as would present least resistance to the motion of the vessel in a narrow channel, or which would give the smallest value of K , in the formula

$$R = K W A H$$

where R is the resistance, A , area of maximum immersed section, H , height due to the velocity of motion, W , weight of a cubic foot of water, and K , a constant depending on the form of the vessel. The least value of K seems to be that for vessels shaped on what is called the wave principle, for which Mr. Scott Russell states, he has found $K = \cdot 05$, while the recognised values for ordinary shapes are $\cdot 16$ or $\cdot 18$. For canals and the shallow or narrow rivers of Ireland all these conditions should be rigorously adhered to, and a class of boats totally different from the clumsy barges now chiefly used should be substituted. On this head, Sir John Macniell has addressed the following excellent remarks to the directors of the Grand Canal Company, which would be equally instructive to all who have any control over inland navigation in this country:

"The barges and boats on your canal are much too large, heavy, and unwieldy; they are a heavy load in themselves, and require considerable power to move them, even at a slow rate, when empty; they are also formed as if they were to be employed as sailing barges, similar to those on the Thames and other rivers; this is a great mistake, and quite unsuited to canal navigation. If the boats were built 60 feet long, 6 feet 6 inches wide, with *upright sides and upright cornered bows*, which would admit two of them to enter a lock at the same time, a great amount of saving would be effected on your canal in the power required to haul such boats, as compared with those now in use, for I have no doubt that six of these boats, carrying 35 tons each, would be as easily hauled as two of the present boats, 50 tons each, or in the ratio of 210 to 100."*

* Report on screw steam-boats employed on the Grand Canal, p. 6.

Although any future improvements in inland navigation in Ireland must necessarily be made with nearly exclusive reference to goods traffic, an instructive illustration of the manner in which the difficulties presented by shallow rivers may be overcome is afforded by what was done several ago in France, on the Loire, by the skill and perseverance of a British engineer.

The river being deprived of its usual supplies of water during the heats of midsummer, steam vessels with the ordinary draught of water were found totally unsuitable. A new boat was constructed, 100 feet long, 10 feet 5 inches broad, 3 feet 6 inches deep, and 5 feet 6 inches in height at the part containing the machinery. The material was sheet iron, one-eleventh of an inch in thickness. She was covered with strong canvass, so as to form a series of cabins, like in a canal passage boat, with small platforms fore and aft. A gangway ran all round, communicating between these platforms. The engine was 24 horse power, with a cylinder 16 inches in diameter, and 2 feet stroke. Wrought iron was employed as much as possible, and every part of the machinery made as light as could be consistent with the required strength. Engine, boiler, shafts, and wheels weighed only 6 tons. The boat and engine complete, 14 tons. With a ton of coals in addition, she drew only 6 inches of water, possessing, as may be supposed, an almost rectangular cross section. She ran for some time between Tours and Orleans, and when the boats that run from Nantes to Angers were stopped from want of water, she was placed on that portion of the river, and is said to have soon realized the cost of construction. Four or five more steamers of the same kind were subsequently built, of greater dimensions, but not drawing more than 10 inches of water. These would, of course, be unsuited for rough weather, but seem to have admirably fulfilled the object for which they were intended.*

The passengers being chiefly under the light canvass deck, the centre of gravity was always kept low during the voyage. It is also probable that when stopping at any of the stations on the river the ingress and egress of passengers took place by the platforms at the end, and not at the paddle-boxes, according to the absurd and dangerous system generally in use, thereby avoiding the risk of giving so light a vessel a heel over the side, which, in such a case, would be attended with serious results.

Of the several modes of communicating motion to vessels on rivers, lakes, or canals, the three most important are direct propulsion by steam, steam towing, and haulage by horses on the banks. The last of these labours under great disadvantages. The line of action is oblique to the direction of motion, whereby force is lost in different ways. If inland navigation is to be brought to any degree of perfection, this method must be entirely superseded. Whether it should be superseded or not, there are certain general principles relative to the motions of vessels in shallow and confined channels, a knowledge of which would greatly assist in devising such arrangements as to economise the tractive or propulsive power

* See the *Artizan* for 1851, pp. 9 and 37.

applied to move the vessels. The mathematical and experimental researches of Professor Challis, Mr. Scott Russell, and Sir John Macneill, have added considerably to our information on these interesting questions. The following is a summary of their principal results:—

The law of resistance in narrow and shallow channels is entirely different from that in open water. This is caused chiefly by the formation of a wave of considerable length, due to the impelling action of the vessel on the confined fluid, the velocity of which is a function of the depth of the channel. It moves most rapidly in deep channels, and slowest in shallow channels. This wave generally precedes the vessel, sensibly increasing the depth of water, a corresponding posterior depression follows it, which similarly lessens the depth of water. In shallow water, when a boat is behind the wave, an increased abnormal resistance is presented to her forward motion from the mass of water before her head. If by strong impulse she were placed on the wave, she would not only be in deep water, but would meet with diminished resistance. A boat moving in shallow water will sometimes take ground at places where she would float if at rest, and also pass over shallows at a rapid velocity, where she would ground if her motion ceased or diminished. In the first instance, if the vessel moves slower than the wave she will occupy the posterior depression, while in the second, if her velocity is equal to that of the wave, she is supported on it, and floats in a depth of water equal to the normal depth of channel, plus height of wave. Passenger boats on some of the canals of Holland are thus made to float over the shallower parts by giving them a higher velocity of motion. By lowering the velocity, the height and depression of the wave would be also diminished. When two boats are passing each other the effect is most sensible, as the resulting depression is equal to the sum of the depressions that would exist separately. I have frequently observed steamers to lessen their speed at low water in tidal estuaries, in order to prevent either or both taking the ground in the depression produced by their motions.

The practical conclusions are, that in narrow and shallow channels the increase of impelling power has a limit, and there is a certain velocity at which a boat may be impelled with a minimum expenditure of force. This velocity must, however, be attained very rapidly, in order to enable the boat to pass the wave, and a sudden impulse from a low to a high velocity is the best mode of effecting the change. In wide and deep channels the requisite impelling power increases with the velocity, but not in a uniform relation. In such cases, when it is hopeless to attain the same speed as the wave, the least velocity consistent with the requirements of traffic will produce least expenditure of power.

In applying steam power to inland navigation it becomes important to determine the best description of boats for navigating both rivers and canals, as well as the best for either separately. In France a great many boats have been constructed for such objects, moved by paddle-wheels at the stern, or by a single one in the centre, or more recently by screws. Among these is one constructed in 1852, on a principle similar to that pointed out by Mr. Bourne in his *Essay on the Steam navigation of Shallow*

Rivers.* She is capable of being divided into two separate parts, forming two distinct vessels, the forward division containing the goods and the after portion carrying the machinery as well as goods. The principal advantage gained by this mode of construction is the facility with which the vessel is enabled to pass through locks in separate divisions, for which she would be too long when entire. The project suggested by Mr. Bourne was anterior to this; he proposes a kind of floating train, analogous to the railway train on land. It is intended chiefly for the shallow and winding rivers of India, but as some of its details may be suggestive of improvements in vessels for combined canal and river navigation, we cannot forbear giving it some notice. He proposes to carry the passengers and cargo, not in the steamer herself, but in a succession of shallow barges, so articulated to the steamer and to one another by circular joints, with a single bow to separate the water for the entire train, instead of an independent bow and stern for each of the constituent barges. The steamer or floating locomotive proposed for the Indian rivers would be 220 feet long by 36 feet broad, with an immersion of 15 or 16 inches. The stern barge 160 feet, with less than 12 inches draught. Average draught of barges should be 12 inches, with 50 tons of cargo in each. In favourable cases he expects a speed of from 12 to 15 miles per hour, with a train of 5 barges. The locomotive, like that on land, carries neither passengers nor goods, she only differs in acting as her own tender. The barges should be so jointed together that only a narrow space would exist between them, at which the plates of the barges mutually overlapping, any intermediate water would be carried as in a tank, and could offer no resistance. Although in this way the resistance of displacement produced by such a train would be comparatively small, the resistances arising from friction and the fluxures of the different parts of the train, would be very considerable. The frequent turnings which are requisite in river navigation would be accompanied by differences in the amount of effective resisting section presented by the train, and the midship section would almost always be far less than that representing the resisting surface. It seems probable, therefore, that there is a limit beyond which it would be injudicious to extend the length of such a train, although it must be acknowledged that it possesses great superiority over the system of towing a group of separate barges.

In the first part of these notes I have mentioned that steam power had been applied to the towing of barges on the Shannon with very useful results. In the experiments made by Sir John Macneill it was found that a much more useful effect was produced in the application of small screw steamers on the Grand Canal by hauling loaded boats, than by carrying goods. But these steamers were essentially tug boats, and the results obtained from them cannot fairly determine the relative merits of the two systems of transport. On some of the rivers of France, such, for instance, as the Rhone, the carrying system has entirely superseded hauling, and cargo steamers of colossal dimensions have been recently introduced

* *Artizan*, vol. 8, p. 145.

for the transport of goods. Some of these are 460 feet long by 23 feet broad, and have an average draught of 4 feet 3 inches. They are worked by engines of about 400 horse power, and move at the rate of from 5 to 6 miles an hour. On the Rhine and Danube the use of cargo steamers seems also to be gradually extending, with a corresponding diminution in the amount of towing.

If the system of jointed vessels already described should not be found to answer, the best application of steam-vessels to the existing canals, would be undoubtedly for towing purposes. I was surprised to learn from an intelligent gentleman connected with one of our principal canals, that the use of tug steamers was not of late regularly continued on the canal. One of the reasons alleged was, that a train of two boats occasions a great and sudden loss of water at locks. This could be in part obviated by the suggestions of Sir John Macneill; and it should be remembered that the absolute loss would in any case be the same, whether the boats were in a group or separate. Another objection arose from the liability of the sparks from the funnels of the steamers lodging in turf ricks and the roofs of thatched buildings near the canal bank, thereby causing destruction of property. This is no doubt partly due to the lightness of the ashes of the peat, the fuel generally consumed in the canal steamers, but without making any change in the description of fuel, which on economical grounds it would be so desirable to retain, this evil could assuredly be averted. Spark arrestors are well known, and frequently employed on the chimneys of railway locomotives, and the last number of this Journal contains a short notice [p. 275] of one which would probably answer in such a case as a canal steamer.

If difficulties of this kind should interfere with the development of inland navigation in Ireland, all the advantages she possesses would be in vain; and it would be long before we could say in the words of M. Gaudry, a French engineer, whose *Essay on River Navigation in France* I have found both interesting and instructive:—"Alongside of the best made and most prudently worked railways, each year witnesses, together with increased traffic on our improved water-ways, an increase in the number and power of the steam vessels."

ART. II.—*Catalogue of the several localities in Ireland where Mines or Metalliferous Indications have hitherto been discovered, arranged in Counties according to their respective Post Towns.*

[THE following very complete list of localities where indications of metallic minerals have been observed, or actual mines opened, was formed during the progress of the General Valuation Survey of Ireland, under the direction of Richard Griffiths, LL.D., Chairman of the Board of Public

* In *Armengaud's Publication Industrielle*, Année 9. p. 75.

Works, for the double object of being employed in the construction of his Geological Map of Ireland, and for distribution among the field officers of the survey. As such a list is of the highest importance to all interested in mining industry, we believe we shall be doing a service in making it more generally known to the public than the official objects for which it was prepared have hitherto permitted it]:—

NOTE.—The localities with an asterisk prefixed are situate in Igneous or Lower Sedimentary Rocks; the remainder occur for the most part in Limestone. Mines *now* or *formerly* worked are printed in Italics, but no opinion as to the relative or actual productiveness of any is intended to be offered; subdenominations of Mineral districts are grouped for convenience between brackets; when Mines have been recognized by other designations, these latter are added in parentheses. The numbers attached to the localities refer to the Ordnance Sheets which contain them. Several authorities and explanatory remarks are interspersed. Collieries are omitted, the Coal-fields being described in Mr. Griffith's Reports, and marked on his Geological Map of Ireland, (now preparing for publication,) from which the following localities have been extracted.

Though metallic lodes have not yet been discovered in the Counties of Carlow, Londonderry, and Westmeath, it is not improbable that such may occur.

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
ANTRIM.		
Ballycastle, ...	Coal-field, (Ballynagard, Torglass, Tornaroan, &c.), Clay-iron-stone and Hematite ...	5 & 9
Carrickfergus,	<i>Duncrue</i> , thick beds of Rocksalt, also Gypsum on Coast from Belfast, Northward ...	52
Larne, ...	*Dundressan, Iron,† ...	41
ARMAGH.		
Belleck, <i>Drumnahoney</i> {	* <i>Carrickgalloghly</i> , Lead,—Mr. Griffith, MSS., Mines of Ireland, 1821 ...	25
Mines,	* <i>Drumnahoney</i> , Lead ...	25
Crossmaglen	* <i>Dorsy</i> , Lead,—discovered by Joseph Backhouse, of London, Esq. ...	28
	*Tullyard, Lead ...	30
	*Tullydonnell, Copper ...	31
Keady ...	*Aughnagurgan, Lead ...	20
	*Clay, Lead and Manganese ...	19
	* <i>Doochat or Crossreagh</i> , Lead,—communicated by William Conn, Esq. ...	19
	* <i>Drummeland, (Derrynoose,)</i> Lead,—worked by the late Lord Farnham, many years ago ...	19
Middletown, ...	* <i>Tamlaght</i> , Lead, ...	15
Newry, ...	*Drumbanagher, (Church Glen,) Lead ...	22
	* <i>Kilmonaghan, (Jerrets or Tuscan Pass,)</i> Copper ...	22
Newtown Hamilton	* <i>Ballintemple</i> , Lead,—communicated by Joseph Backhouse, Esq. ...	25
Pointzpass, ..	* <i>Ballymore Mines</i> , Lead,—exact position not ascertained, 18, &c.	

† When the word Iron occurs alone, Magnetic, Specular, or other Ores, (proper,) of Iron are those intended; thus distinguishing them from Clay-ironstone, a regular rock formation.

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
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CAVAN.

Cavan,	... *Farnham Demesne, Copper	...	20
Cootehill,	... *Cornanurney, (<i>Wheal Burrowes</i>), Lead	...	22
Shercock,	... *South East of, Lead	...	29, &c.
Swanlinbar	... <i>Cuilcagh District</i> , Clay-ironstone—Mr. Griffith's Coal Reports,	6	

CLARE.

Ballyvaghan,	... Cappagh, Copper, Argentiferous Lead, and Manganese	6
Feakle	... *Corrakyle, Copper	20
	... *Glendree, Lead	19 & 27
	... *Leaghort, Copper,—communicated by R. Purdy Allen, Esq., Sec. to Mining Co. of Ireland	20
Newmarket-on-Fergus,	... <i>Carroonakilly</i> , Argentiferous Lead	42
Quin	... <i>Ballyhickey</i> , Argentiferous Lead, and Copper with Zinc	34
Castletown Mines,	... <i>Castletown</i> , Lead	34
	... <i>Moyriesk</i> , Argentiferous Lead	34
	... <i>Monaoe</i> , (<i>Kilbreckan</i>), Argentiferous Lead, and Antimony,—supposed <i>Kilbreckanite</i>	34
Roadford	... <i>Crumlin</i> , Argentiferous Lead	4
	... <i>Doolin</i> , Argentiferous Lead	8
Sixmilebridge,	... <i>Rathlaheen South</i> , Lead and Sulphur Ore,—communicated by R. W. Townsend, Esq.	51
Tomgraney,	... * <i>Ballyhurley</i> , Lead,—Mr. Griffith's MSS., Mines of Ireland	29
Tulla,	... <i>Ballyvergin</i> , Lead, Copper, and Sulphur Ore,—communicated by R. W. Townsend, Esq., A.M.	26
	... <i>Knockaphreaghau</i> , (<i>Crow Hill</i>), Argentiferous Lead	34
	... <i>Miltown</i> , Silver and Lead,—worked by the Bullion Mining Company	35

CORK.

Ballydehob	... * <i>Ballycummisk</i> , Copper,—see Mr. Griffith's Report on Audley Mines	140
	... * <i>Cappaghglass</i> , (<i>Cappagh</i>), Copper	140
Audley Mines,	... * <i>Foildnamuck</i> , Copper	140
	... * <i>Horse Island</i> , Copper,—Traces of Lead occur in the Gossans of all these mines	149
	... * <i>Rosshrin</i> , Copper	140
	... * <i>Ballydehob</i> , Copper,—worked by South Cork Mining Co.	140
Ballydehob Mines,	... * <i>Boleagh</i> , Copper	140
	... * <i>Coaragurteen</i> , Copper	140
	... * <i>Kilcoe</i> , Copper	140
	... * <i>Skeaghanore</i> , Copper	140
	... * <i>Derreenaloman</i> , Copper	131
Roaringwater Mines,	... * <i>Kilkilleen</i> , Copper and Lead	140
	... * <i>Laheratanally</i> , Copper	140
	... * <i>Leighcloon</i> , Copper	140
Bantry	... * <i>Carravilleen</i> , Copper	129
	... * <i>Clashadoo</i> , (<i>Four Mile Water</i>), Copper	130
	... <i>Derrengreanagh</i> , Copper and Sulphate of Barytes,—communicated by R. W. Townsend, Esq.	118
	... * <i>Glanalin</i> , Copper	129
	... * <i>Gortavallig</i> , Copper	138
Hollyhill Mines,	... * <i>Gortacloona</i> , Lead	118
	... * <i>Hollyhill</i> , Copper	118
	... * <i>Killeen</i> , Copper	129
	... * <i>Killovenoge</i> , Argentiferous Lead	117

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
Bantry	... * <i>Rooska East</i> , Argentiferous Lead	... 117
Carigtohill,	... <i>Vicinity of</i> , Lead with Zinc,—Mr. Courtney's Estate	75 & 76
Castletown-	... * <i>Allihies</i> , Copper,—Mr. Griffith, MSS.	... 114
Bearhaven,	... * <i>Cahermeeleboe</i> , Copper	... 127
<i>Bearhaven</i>	... * <i>Caminches</i> , Copper	... 114
<i>Mines,</i>	... * <i>Cloan</i> , Copper	... 114
	... * <i>Coom</i> , Copper	... 114
	... * <i>Kealoege</i> , Copper	... 114 & 127
	... * <i>Kilkinnikih West</i> , Lead	... 127
	... * Killaconenagh, traces of Lead and Copper in several places	... 115, 128, &c.
Castletownsend,	... Cooscroneen, Copper,—communicated by R. W. Townsend, Esq., A.M.	... 142
	... Rabbit Island, (Squince,) Antimony, Copper, and Lead	... 142
Clonakilty,	... * <i>Dunee</i> , Lead, Copper, and Sulphate of Barytes,—worked chiefly for Barytes at present	... 144
Cloyne,	... Rostellan, Hematite and China Clay—the latter extensively worked by Mr. James Deering. [Ed.]	...
Cork, * <i>Rathpeacon</i> , Copper, (traces of Malachite)	... 63
Crookhaven	... * <i>Altar</i> , Copper	... 148
	... * <i>Ballydivlin</i> , Copper	... 147
	... * <i>Ballyrisode</i> , Copper,—communicated by R. W. Townsend, Esq., M.E.	... 147
	... * <i>Balteen</i> , Copper	... 147
	... * <i>Carrigacat</i> , (<i>Dhurode</i> .) Copper and Auriferous Gossan	... 147
	... * <i>Boulysallagh</i> , (<i>West Carbery</i> .) Copper, Silver, and Lead	... 147
	... * <i>Callaros</i> , Copper	... 147
	... * <i>Cloghane</i> , (<i>Mizen Head</i> .) Copper	... 146
<i>Crookhaven</i>	... * <i>Crookhaven</i> , Copper,—worked by Crookhaven Mining Co.	... 147
<i>Mines,</i>	... * <i>Kilbarry</i> , Copper	... 147
	... * <i>Mallavoge</i> , (<i>Brow Head</i> .) Copper,—property of Lord Charles Clinton, M.P.	... 152
	... * <i>Spanish Cove</i> , (<i>Kilmoe</i> .) Copper and Argentiferous Lead	... 147
	... * <i>Lackvaun</i> , Copper	... 147
	... * <i>Toormore</i> , Copper	... 148
Dunmanway, * <i>Demesne</i> , Mundie	... 107 & 108
	... * <i>Derreens</i> , Copper,—communicated by R. W. Townsend, Esq., M.E.	... 107
	... * <i>Coom</i> , (<i>Lackue Wood</i> .) Copper,—property of John D'Arcy Evans, Esq.	... 107
<i>Lackue Mines</i>	... * <i>Inchanadreen</i> , Copper,—communicated by Fitz-Lionel Fleming, Esq.	... 107
Glengarriff,	... * <i>Esk Mountain</i> , Copper	... 90
Millstreet,	... * <i>Vicinity of</i> , Copper	... 39
Nohaval,	... * <i>Minane</i> , Lead	... 99
<i>Ringabella</i>	... * <i>Ringabella</i> , Argentiferous Lead	... 99
<i>Mines,</i>	...	...
Ross Carbery,	... * <i>Aghatubrid</i> , Manganese and Copper,—Mr. Griffith, MSS.,	... 142
	... * <i>Derry</i> , Copper,	... 143
<i>Glandore</i>	... * <i>Drom</i> , Copper,	... 142
<i>Mines,</i>	... * <i>Keamore</i> , Copper,	... 142
	... * <i>Kilfinnan</i> , Copper,	... 143
	... * <i>Rouryglen</i> , Manganese and Iron,	... 143
	... * <i>Gortagrenane</i> , Copper,—communicated by R. W. Townsend, Esq., M.E.,	... 143
	... * <i>Little-island</i> , Copper and Sulphate of Barytes,	... 143
Skibbereen,	... * <i>Bawnishall</i> , Copper,	... 151
Skull,	... * <i>Castlepoint</i> , Copper,	... 148

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
Skull,	* <i>Castle Island</i> , Copper, ...	149
<i>Cooheen Mines</i> ,	* <i>Coosheen</i> , Copper and Iron, ...	139 & 140
	* <i>Gortnamona</i> , Copper, ...	140
	* <i>Long Island</i> , Copper, ...	148
	* <i>Skull</i> , Copper, ...	148
	* <i>Leamcon</i> , Copper,—communicated by R. W. Townsend, Esq., A.M., and M.E., ...	148
	* <i>Mountgabriel</i> , Copper, ...	139

DONEGAL.

Ballybofey, ...	* <i>Welchtown</i> , Lead and Iron, ...	68
Ballyshannon,	<i>Abbey Island</i> , Argentiferous Lead with Zinc, and Copper, ...	107
	<i>Abbeyslands</i> , Argentiferous Lead with Zinc, and Copper, ...	107
	<i>Ballymagrorty</i> , Lead ...	103
	<i>Finner</i> , Argentiferous Lead with Zinc, and Copper, ...	107
	<i>Tonreege</i> , Lead, ...	107
Bundoran, .	Vicinity of, Lead and Copper, ...	106
Carnodonagh ...	* <i>Carroumore or Glentogher</i> , Argentiferous Lead with Zinc, and Sulphur Ore, ...	20
	* <i>Clonca</i> Copper, ...	4, 5, &c.
Dunfanaghy, ...	* <i>Ards</i> , Lead, ...	16 & 26
	* <i>Keeldrum Upper</i> , Lead, ...	33
	* <i>Marfagh</i> , Lead, Copper, Sulphur Ore and Iron, ...	15
Glenties, ...	* <i>Drumnacross</i> , Lead ...	74
	* <i>Fintown</i> , (<i>Loughnumbraddan</i>), Lead,—property of James Hamilton, Esq., see Giesecke's Report to the Royal Dublin Society, ...	66
	* <i>Gweebarra</i> River, Lead ...	65, &c.
	* <i>Kilrean</i> , Lead, ...	74
	* <i>Mullantiboyle</i> , Lead,—formerly worked by Sir Albert Conyngham, abandoned from influx of Owenea River, —Mr. Griffith, MSS., Mines of Ireland, ...	74
	* <i>Sernag's Mountain</i> , Lead with Zinc, and Sulphur Ore, ...	66 & 67
Killybegs, ...	* <i>Malinbeg</i> , Argentiferous Lead, and Manganese, worked by Mr. Willans, ...	89
	* <i>Eighterross</i> , (<i>Castlegrove</i>), Lead, ...	53 & 54
Naran, ...	* <i>Iniskeel</i> , Coast of, Lead and Copper, ...	64, &c.

DOWN.

Annalong, ...	* <i>Glasdrumman</i> , Copper and Lead, ...	53
Ardglass, ...	* <i>Ardtole</i> , Lead, ...	45
	* <i>Guns Island</i> , Lead, Copper and Sulphate of Barytes, ...	30
Bryansford, ...	* <i>Fofanny</i> , Lead,—Mr. Griffith, MSS., Mines of Ireland, ...	48
Crawfordsburn, ...	* <i>Ballyleidy</i> , Lead ...	1
Dromara, ...	* <i>Slieve Croob</i> District, (<i>Begny</i> , <i>Gransha</i> , <i>Legananny</i> , <i>Moncynabane</i> , &c.), Iron, ...	28, 29, 35, & 36
	* <i>Vicinity of</i> , Lead and Manganese, ...	21 &c.
Dromore, ...	* <i>Moneylane</i> , Lead, ...	43
Dundrum, ...	* <i>Wateresk</i> , Lead,—communicated by Joseph Backhouse, Esq., ...	43
	* <i>Canreagh</i> , Iron, ...	14
Hillsborough, ...	* <i>Leitrim</i> , (<i>Leitrim Hill</i>), Lead,—communicated by Dr. Saunderson, ...	55
Kilkeel, ...	* <i>Mourne Mountains</i> , Copper and Lead, ...	52, &c.
	* <i>Ballydargan</i> , Lead, ...	44
	* <i>Killough</i> , Lead, ...	45
	* <i>Rathmullan</i> , Lead ...	44
Killough, ...	* <i>Saint John's Point</i> , Copper and Sulphur Ore, ...	45

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
Killyleagh, ...	* Corporation, Lead, ...	31
Newtown Ards, ...	* Whitespots, (Conlig), Lead,—worked by Newtown Ards Mining Company; see Professor Haughton's Paper on Gangue, Jour. Geol. Soc. Dub., ...	6
Strangford, ...	* Tullyratty, Copper and Argentiferous Lead,—Mr. Griffith, MSS., ...	31
DUBLIN.		
Dublin, ...	Ashtown, Lead, ...	14 & 18
	Castleknoch, Lead ...	17
	Cloghrag, Lead, ...	14
Clontarf Mines, {	Clontarf, Lead with Zinc,—first shaft sunk 1809, Mr. Griffith, MSS., Mines of Ireland, ...	19
	Killester, Lead ...	19
	Crumlin, Lead, ...	22
	Dolphinsbarn, Lead with Zinc,—abandoned from influx of water, Mr. Griffith, MSS., ...	18
	Kellystown, Lead, ...	13 & 17
	Kilmainham, Lead, ...	18
	Phoenix Park, Lead, ...	18
Golden Ball, {	* Ballycorus, (Mount Peru), Argentiferous Lead with Zinc, and Native Silver, ...	26
Ballycorus Mines, {	* Rathmical, Lead,—Directors of Mining Company, Dr. Barker, T.C.D., I. English, Esq., Sir R. Kane, &c., ...	26
	* Shankill, Lead, ...	26
Howth, {	* Howth, Lead, ...	16
Howth Mines, {	* Sutton, Manganese, ...	15
Kingstown, ...	* Dalkey, Lead with Zinc, and Tin,—Mr. Griffith, MSS., ...	23
	* Mount Mapas, (Killiney Hill), Lead, ...	23
	* Seapoint, Copper, ...	23
Rush, ...	* Lambay Island, Copper, ...	9
	Loughshinny, Copper,—Mr. Griffith's Mining Report of Province of Leinster, ...	5
FERMANAGH.		
Belleek, ..	Rossbeg, (Castle Caldwell), Copper and Iron,—communicated by George C. Mahon, Esq., property of J. C. Bloomfield, Esq., ...	9
GALWAY.		
Ardrahan, ...	Ballymaquiff, Argentiferous Lead, and Bismuth,—property of F. M. S. Taylor, Esq., ...	113 & 114
	Muggaunagh, Lead and Copper, ...	103
	Parkatleva, Lead, ...	103
Clifden, ...	* Ardber, Copper, ...	35
	* Boolard, Copper, ...	22
	* Cloon, Copper, ...	22
	* Derrylea, Lead,—worked by Messrs. Gibbs, Baxter and Reynolds, property of S. Jones, Esq., ...	36
	* Doon, Copper, ...	22
	* Dooneen, Copper,—Report by Pierre J. Foley, Esq., M. E., for Connemara Mining Co., ...	22
	* Fakeeragh, Copper, ...	35
	* High Island, Copper, ...	21
	* Rinyle District, (Dawrosmore, Cloonloaun, Cashleen, &c.),—Iron and Copper,—Estate of Archdeacon Wilberforce, see Dr. Apjohn's Paper, Jour. G.S.D., ...	9 & 23

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
Galway,	... *Carrowroe South, Lead, ...	90
	*Derrynea, (<i>Cashla Bay</i>), Lead,—Mr. Griffith's Lectures on the Mines of Ireland, ...	79
	*Docks of, Mundic, ...	94
	*Inveran, Lead,—Mr. Griffith's Lectures before R. Dub. Soc., Mines of Ireland, ...	91
	*Kilroe West, Lead, ..	92
	*Lenaboy, (Salt Hill), Lead,—communicated by John L. Worrall, Esq., C.E., ..	94
	*Spiddle, Lead, ...	92
Kinvarra,	... Caherglassaun, Argentiferous Lead,—worked by Connemara Mining Company, ...	122
Moycullen,	... Wormhole, (<i>Gortmore</i>), Lead, ...	68
Oranmore,	... Rinville West, Lead with Zinc, and Sulphur Ore ...	94
Oughterard,	... *Ballygally, Sulphur Ore,—formerly worked by Mr. Nimmo,	40
Canrauer	{ *Canrauer West, Lead, ...	54
Mines,	{ Cregg, Lead, communicated by G. F. O'Flahertie, Esq.,	54
Claremount	{ *Claremount, Lead, ...	54
Mines,	{ *Glengowla East and West, Lead with Zinc, ..	54
	{ Tonweeroe, Lead, ...	54
	{ *Barratleva, Copper,—property of, and worked by Henry Hodgson, Esq., ...	39
Curraghduff	{ *Curraghduff Middle, (<i>Glan</i>), Copper and Sulphur Ore,—	
Mines,	{ property of W. Downes Griffith, Esq., ...	39
	{ *Derroua, Copper,—property of, and worked by Henry Hodgson, Esq., ..	39
Oughterard,	... *Dooghta, Mundic,—communicated by Sir Richard O'Donnell, Bart, ...	26
	*Dooros, Copper and Sulphur Ore, ...	39
	*Drumsnauw, (<i>Doon</i>), Copper, Manganese, Iron and Lead,	39
	*Griggins, Argentiferous Lead, ...	25
	*Lecnaun, Lead and Copper,—Mr. Griffith, MSS.,	12
Lemonfield	{ Ardvarna, Lead, ...	54
Mines,	{ Lemonfield, Silver and Lead,—worked by G. F. O'Flahertie,	54
	{ Portacarron, Lead, ...	54
Roundstone,	... *Vicinity of, Lead, ...	50

(To be continued.)

ART. III.—Application of Gluten for the manufacture of various articles of Food. By M. F. DURAND, Baker, of Toulouse.

THE eminently nutritive properties of gluten are acknowledged by all the scientific men who have occupied themselves of late years with the hygienic and physical properties of aliments. The favourable reports of the Scientific Congress, the Academy of Sciences of Paris, the Medical Society and Academy of Sciences of Toulouse, and very recently, the extended report of the Academy of Medicine, have made the public acquainted with the utility of gluten, not alone in a hygienic point of view, but also in reference to its connexion with the healing art, to which it is capable of rendering great service. It is thus that M. Magendie, the

reporter, in the name of the commission upon gelatine, composed of MM. Thenard d'Arcet, Flourens Serres, and Breschet, speaks of the nutritive properties of gluten: "Gluten separated from wheaten or maize flour offered to us a phenomenon which we did not observe in experimenting with the proximate organic principles, all of which excite more or less repugnance among animals obliged to live upon them, or to eat them, more or less. Gluten, although its odour is insipid, and to some extent disagreeable, and that there is nothing agreeable in its flavour, was taken without difficulty from the first day, and the animals have continued to make use of it during three months uninterruptedly without the slightest symptom of disgust. The dose was from $3\frac{3}{4}$ to $4\frac{3}{4}$ ounces per day, and the animals preserved all the character of excellent health. This substance, formerly considered as a proximate azotized body, does not excite any repugnance or disgust without either preparation or seasoning, and alone nourishes perfectly and during a long period."

M. Bouchardat, Professor of Hygiène to the Paris faculty, has proved in his treatise upon Diabetes the excellence of gluten, and the advantages which medicine might derive from it. Already, in 1838, M. Bouchardat, in a memoir presented to the Academy of Sciences, on the nature and treatment of *diabetes mellitus*, showed that diastase existed in the stomachs of diabetic patients, and that medicines ought to occupy only a secondary place in the treatment of this disease, whilst hygienic means, such as food, dress, and exercise, should be preferred to all therapeutic agents. The most important of these means is food in an especial manner. In cases of diabetes, M. Bouchardat recommends the suppression, or at least the diminution of all starchy food, and the almost exclusive employment of azotized aliments. Bread, that first food of man, formed in great part of amylaceous substances, ought to be banished from the food of patients affected with this disease; but it happens that this privation, acutely felt by the greater number of persons subjected to such a regime, exposes them to a satiety and to *anorexia*, or loss of appetite. To avoid the great inconvenience in carrying out a nitrogenous diet, M. Bouchardat recommends the use of a kind of bread, which he calls *gluten bread*, composed of four parts of fresh gluten and one of wheaten flour. This addition to the food of diabetic patients has been always considered by M. Bouchardat as an article of food capable of replacing ordinary bread without its inconveniences, and not as a therapeutic agent.

M. E. Martin, apothecary, of Vervins, who had obtained the prize of the "*Société d'Encouragement*" for having isolated the gluten in the preparation of starch, was the first who, at the instance of M. Bouchardat, in 1841, made some bread, in the proportions which we have just cited—proportions considered at that time as indispensable in producing panification.

In the commencement of 1842, M. Payen having spoken in one of his lectures on chemistry of gluten bread, and of the application which M. Bouchardat made of it, M. Robine, Syndic of the bakers of Paris, who happened to be present at the lecture, departed with the determination to prepare such a bread, and accordingly did so, and furnished it to consumers not only in Paris, but in the provinces. M. Robine added to the bread

some butter, eggs, cheese, and other substances adapted to assist the therapeutic action of this aliment, according to the taste of patients.

M. Bouchardat considers gluten bread as a very nourishing article of food, suited for persons weakened by age or by privations, or also by long illness, and as of the greatest use to patients labouring under dyspepsia and gastritis. Since the remarkable labours of M. Bouchardat on diabetes, experience has demonstrated that gluten bread may also be of great advantage in several diseased affections, both in children and adults.

In 1844, M. Durand made several attempts to panify pure gluten, the results of which he submitted to the judgment of the jury of the Toulouse Exhibition of 1845. Honourable mention was accorded to him; this encouragement redoubled his zeal, and at the exhibition of 1850, M. Durand received as a recompense for the improvement which he had effected, a bronze medal. The gluten bread of M. Durand is exceedingly light; it has the appearance of bread, the dough of which has been perfectly worked, and a sufficiently agreeable taste; it is somewhat elastic, but when slightly heated it becomes friable, and may then be easily ground. The *semoule*, or semolina, which M. Durand also prepares with his gluten bread, is capable of replacing the different amylaceous substances employed in making soups, in all cases where substances containing starch should be avoided, and competes advantageously with the granulated gluten of MM. Véron, a product derived from the residual gluten of their vast factory for the preparation of starch by the washing process. The granulated gluten of these gentlemen does not contain, according to the report of M. Payen, made in 1845, more than 25 per cent. of dry gluten, while the semolina of M. Durand contains 80, and it may even be made with pure gluten bread.

The *semoule* made with gluten bread, which has undergone all the phases of panification, does not contain, like the granulated gluten of MM. Véron, raw starch. Hence it has the great advantage of incorporating itself with soup, milk, and water, without long boiling, and of being very easily digested.

M. Durand having perceived the inconvenience which the ordinary mode of heating his gluten bread has caused to those who use it, has had constructed a small portable stove which may be easily heated by hot iron, or an oil or alcohol lamp.

The different points to which the improvements introduced into the manufacture of gluten bread refer, are, to the choice of the glutens which he employs, to the perfect desiccation of the bread produced, which ensures its preservation, to a very slight roasting which he subjects it to, and which renders it less disagreeable, and finally to the employment of the small apparatus which permits of its being re-heated and eaten in good condition long after its preparation.

The gluten bread, such as it was at first prepared by the bakers to whom M. Martin applied, and subsequently by the late M. Robine, Syndic of the Parisian bakers, laboured under the great disadvantage that it could only be preserved for a limited time; great difficulty was therefore encountered in sending it to the provinces. M. Durand has had the

good idea of preparing a bread cut into thin slices, which he is thus able to obtain as free as possible from moisture, which then requires for its perfect preservation only to be kept in a very dry place, and secured from the attacks of insects.

The gluten flour prepared by M. Martin had, without doubt, the great advantage of being capable of being preserved for a long time, an essential condition when it was required to be sent as an article of trade to a considerable distance. M. Durand's bread can also be preserved, and will be preferred by those persons who do not wish to be compelled to prepare bread at least every week, as must be done with the flour of M. Martin. It must, however, be added, that the bread prepared with M. Martin's flour resembles ordinary bread much more than that obtained by the manufacturer of Toulouse, which resembles as much Brussels biscuits as it does ordinary bread. We must also add, that M. Durand prepares breads more or less rich in gluten, as in the case of the flour of M. Martin.

The most ingenious idea which M. Durand has had to render the gluten bread less disagreeable, was to submit it, after it was cut into slices, to a slight roasting, which destroyed its elasticity, and most efficaciously modified the mode in which it might be triturated with other substances, in communicating to it an agreeable flavour. This torrifed bread is perfectly dry, but exposed to the air it recovers in part its elasticity, in absorbing moisture. It is in order to restore to it this friability that M. Durand has had the idea of constructing his small tin-plate stoves, by means of which the friability and other advantages may be again communicated to his bread in a short time.

M. Durand's gluten bread is made with gluten extracted from wheaten flour by simple washing, which carries off the starch and leaves the gluten. The proportion of gluten in wheat varies according to the quality. The wheat of Toulouse produces a flour which contains 10 to 12 parts of gluten in 100 of the soft wheats. The proportion is greater in the semi-hard wheats, and certainly very much so in the hard varieties. The rest is starch. The process by which the gluten is obtained, which, as we have stated, is by washing out the starch, is long and expensive, hence the pure gluten bread of M. Durand is dear; nevertheless there is a certain demand for the use of persons attacked with diabetes, a disease much more general than is commonly believed, and very often affecting persons without their being aware of it.

A bread is also made of maize flour, a starchy substance, to which from 10 to 12 per cent. of gluten extracted from wheaten flour is added. In this way a bread is obtained almost as rich in nutritious constituents as that made with wheaten flour. This bread has an excellent appearance; it has an agreeable odour, which the ordinary maize bread has not; it is white, well flavoured, and what constitutes its principal merit, it costs scarcely more than half, or at most two-thirds, as much as ordinary bread. This result is, of course, arrived at when gluten is made on a great scale.

Wheaten flour, as we have said, contains from 10 to 12 per cent. of gluten, the rest is starch. Formerly the starch makers allowed the gluten to be lost, so little did they understand their operations. This valuable

substance, gluten, passed into a state of putrefaction, and in this state served, at most, only to feed pigs. At present the gluten is separated in a state of purity from the starch by improved processes; a granulated substance is made with it suitable to make very good and very nourishing soups. It is by the establishment of a large starch works that M. Durand will procure the gluten at a cheap rate, and that he will be able to realize on a great scale that which he has hitherto been able to do only on a small scale, and as a mere experiment.

M. Durand uses moulds for baking his gluten bread, having a square section and slightly conical, that is, smaller at bottom, in order that the bread may be more easily withdrawn after having been baked. As soon as the paste is introduced into the mould, it is covered with a moveable cover which rests upon the paste, in order that its development may be progressive; the weight of the cover should be proportioned to the degree of purity of the gluten. Two iron triangles, placed at each extremity, serve to prevent the cover from escaping out of the mould, and limit the development of the paste. This last condition is essential, because heat having a considerable influence upon gluten, if its development was not strongly compressed, it would become excessive, and would render the bread incapable of being handled. It is for the same reason that the baking should be effected in an oven moderately heated, and that in the preparation of gluten bread from wheaten flour no yeast should be employed. The manipulation of dough should be effected by the hands, and as actively as possible. In order to do so it is necessary to choose the most favourable moment, which is known by the degree of humidity of the material, the degree of which should be in harmony with the quantity of starch intended to be united with the gluten.

We shall here indicate the proportions which M. Durand has employed most successfully in forming his mixtures of gluten with other alimentary substances:—

1. Pure gluten bread, with the addition of 1 per cent. of common salt.
2. Bread composed of 90 per cent. of moist gluten, 10 per cent. of wheaten flour, and 1 of common salt.

The proportions of these substances vary up to 60 per cent. of moist gluten, 40 per cent. of wheaten flour, and 1 of salt.

3. The same kinds of bread, with the addition of 3, 5, 8, or 10 per cent. of fresh butter.

We must also speak of an application which M. Durand has made of gluten to the manufacture of chocolate. This chocolate, which is made in the ordinary way, is composed of the following proportions:—

1. 334 grammes of cacao, 160 grammes of gluten bread reduced to an impalpable powder.
2. 200 grammes of cacao, 200 grammes of sugar, and 100 grammes of gluten bread reduced to powder.
3. 200 grammes of cacao, 250 grammes of sugar, and 50 grammes of pulverized gluten bread.
4. 200 grammes of cacao, 200 grammes of sugar, and 100 grammes of pure gluten flour, equally reduced to the condition of an impalpable

x

powder; each of the materials composing this chocolate should be separately pulverized, and with care.

5. *Chocolat au gluten*, in which fresh gluten is rendered less coherent by the addition of half its weight of water, containing 0.002 of pure hydrochloric acid, and dried in a stove. The proportions being 200 grammes of cocoa, 200 grammes of sugar, and 100 grammes of moist gluten.

The semoule or semolina of gluten bread may be prepared from any of those above mentioned. For this purpose the bread must be dry, for it is only after having been subjected to the action of heat that it can be pulverized.

To prepare the gluten bread *à la farine de maïs*, the same process should be used as in making the gluten bread with wheaten flour, with the addition, however, of a yeast composed of two-thirds of wheaten flour, and one-third of common water.—*Le Genie Industriel*, August, 1854.

[A large quantity of wheaten starch is annually made in Ireland, and all by processes, so far as we are aware, in which the gluten is lost. We have translated the present paper for the purpose of calling attention to the subject generally, and especially for the purpose of recommending to those engaged in starch making, the economical, healthy, and perfect process of M. Martin, of Vervin, in which the gluten as well as the starch is obtained in a state of purity. We can see no reason why the same valuable applications which have been made of gluten in France, should not be carried on in Ireland, more especially as we actually import several of these products.]

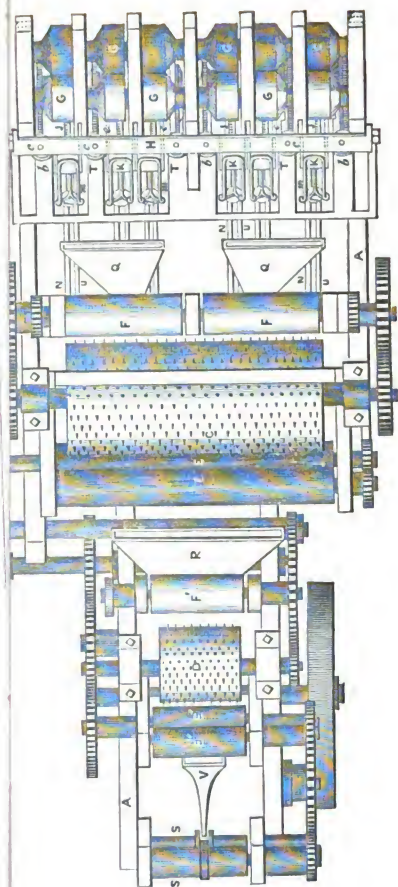
ART. IV.—*Improvement in Dressing Flax.*

[WE shall endeavour, in all future numbers of the JOURNAL OF INDUSTRIAL PROGRESS, to bring under the notice of our readers every supposed improvement in the chemical or mechanical preparation of flax and of linen fabrics, made in America, on the Continent, or in these countries, which shall come within our knowledge. In doing so, it is of course to be understood, that we do not pledge ourselves to the value of the supposed improvement. It is quite as important for those engaged in a great branch of industry to become acquainted with those processes which have failed as with those which have been successful. Very often the former contain the germs of real improvements, which in skilful hands may be developed. Hence it is that we propose to give a place to every project upon this subject with which we may become acquainted.]

The annexed engravings represent an improvement in the dressing of flax, for which a patent was granted to E. L. Norfolk, of Salem, Mass. on the 9th of May last.

Fig. 1 is a longitudinal vertical section of a machine having the im-

IMPROVEMENT IN DRESSING FLAX.



provements, and fig 2 is a plan of the same; fig. 3 is a perspective view of one of the regulating trunks, and fig. 4 is a longitudinal vertical section of the same. Fig 5 is a plan of part of the apparatus which regulates the feed. Similar letters of reference indicate corresponding parts in each of the several figures.

The invention consists in a certain device for regulating the movements of the rollers which supply the flax to the machine, whereby the rollers are made to feed the material at a speed corresponding inversely with the quantity passing between them, or to stop entirely when the quantity become so great as to render a stoppage necessary. The working parts of the machine are all supported by the frame, A, and receive motion from the driving shaft, B. In this machine only two toothed cylinders, C and D, are used, the first of which, C, revolves at a comparatively slow speed, and is placed in suitable bearings between the pair of drawing rollers, E E, and the two pairs of feed rollers, F F, all of which are hung in suitable bearings, parallel with it, and as close as practicable to the points of its teeth. The peripheries, F F, revolve at about one-sixth of the speed of the points of the teeth of the cylinder, C, and those of the drawing rollers, E E, at the same, or a little greater speed than the points of the same teeth. The second toothed cylinder, D, is placed in suitable bearings between a pair of feed rollers, F' F', and a pair of drawing rollers, E' E', which are also hung in suitable bearings, and revolve at about the same speed, in relation to the points of its teeth, as the first-named feed and drawing rollers do to the teeth of the first cylinder. The feed rollers, F' F', must revolve at the same speed, or faster than the drawing rollers, E E, hence the points of the teeth of D will revolve at about six times the speed of those of C. The feed rollers, G G G, which supply the flax in the first instance to the machine, are in six sets (fig. 2); but any number of sets may be used, each hung in independent bearings; there are three rollers in each set, and they receive an intermittent rotary motion by the following means: on the lowest rollers of each set is a toothed wheel, *a*, into which gears an endless screw, *b*, near the upper end of an upright shaft, *c*, which works in bearings in a cross-piece, H, at the top, and a support, I, at the bottom; this shaft carries, near its lower end, a toothed wheel, *d*, which gears into the teeth, *e*, on the face of one of six wheels, J (of which one is for each set of feed rollers) which are all hung loosely on a horizontal shaft, K. Each of the wheels, J, in addition to teeth, *e*, on its face, has teeth on its periphery, and the last-named teeth are engaged by two parts, *h h*, attached to the short levers, L L', both working loosely on the shaft, K, as a fulcrum; these levers are connected by two curved links, M M, which partly encircle the shaft, K, to a bar, N, which slides freely in horizontal guides *f* and *g*, one lever occupying a position above and the other below the shaft, and the pawls, *h h*, being so arranged that when a horizontal reciprocating motion is given to the bar, N, the levers will cause the pawls to act alternately to turn the wheel in the direction of the arrow shown on it in fig. 1, as the bar moves in the opposite directions, the pawls being always kept in working position by springs, *i i*. The reciprocating movement of the bar, N, necessary to work the levers and pawls, is given by means of six

eccentrics, O, (of which one is for each set of feed rollers) on a shaft P, which receives motion through gearing from the main shaft, and a spring, *j*, which is connected to the bar, N, and to the guide *g*; the bar being forced back or towards the wheel, J, by the eccentrics, and being drawn forward against a suitable stop, which will be hereafter described, by the spring, *j*. The intermittent rotary motion of the wheel, J, gives a similar motion to the upright shaft, *c*, and by it is communicated to the rollers, G G G, at a greatly reduced speed. The speed of the revolution of the shaft, P, is such that the revolution given to the feed rollers, G G G, is much slower than that of the rollers, F F, as the latter, in addition to serving as feed rollers to the cylinder, C, serve as drawing rollers, and give the first draw to the fibres. The position of the several eccentrics on the shaft, P, should be such, that they will cause the intermittent movements of the rollers, G G G, to commence successively, and not all at once, to insure greater regularity in the aggregate feed. The quantities of fibre delivered by the several sets of rollers, G G G, are collected into two larger quantities, by passing through two funnels, Q Q, (fig. 2) one behind each pair of rollers, F F, and so collected, are fed by the latter rollers to the drawing rollers, E E, by which they are drawn out. During the drawing operation the toothed cylinder, C, opens and separates the fibres, combs, (or lays them straight and parallel,) and takes out all the tow. After leaving the drawing rollers, E E, the fibres are conducted through a funnel, R, which collects them all in one quantity, and so collected conducts them to the rollers, F' F', which feed them to the next pair of drawing rollers, E' E', by which they are again drawn out. During the second drawing the fibres are submitted to the operation of the second toothed cylinder, D, which repeats the operation of the cylinder, C. From the rollers, E' E', the material is delivered into another funnel, V, by which they are condensed from the form of a thin flat sheet into a sliver, and conducted between two rollers, S S, which compress them together and deliver them in a condition for roving. The combination of the toothed cylinders, C and D, and the rollers E E and E' E', and F F and F' F', is found to effect the separating, straightening, drawing out, and cleaning of the fibres with an extraordinary degree of perfection and rapidity; and by separating the feed which supplies the machine in the first instance, and then drawing, and afterwards doubling repeatedly, the sliver is made of comparatively uniform thickness; but, in order to make the uniformity perfect, it is necessary to equalize in the greatest possible degree the feed from each set of rollers, G G G; and for this purpose I employ the trunks, T, one for each set of rollers, placed as close as possible in front of the rollers, and open at the back and front, to allow the free passage of the flax. The trunks are attached to the cross-piece, H, and each is furnished with a mouth-piece or lid, *k*, (fig. 3 & 4) which is hinged at its back end, at the upper

Fig. 3.

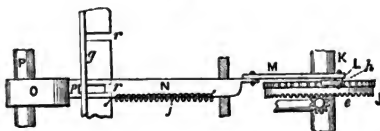


Fig. 4.



part of the back of the trunk, and has its front end resting upon the bottom of the trunk, or upon whatever is placed therein or passing through it—resting therefore upon the flax. A weight, *l*, (fig. 1) is suspended from the end of a pair of arms, *m m*, (fig. 3) which stand out from the front of the lid or mouth-piece; and this weight causes the flax to be tightly compressed in the trunk. The arms, *m m*, are connected by a rod, *n*, (fig. 1) to the short arm of a lever, *U*, of the first order, which works upon a fixed fulcrum, *o*, the longer arm of said lever having a wedge, *p*, suspended from it, which wedge constitutes the stop before alluded to for arresting the forward motion of the bar, *N*. The wedge, *p*, works in a slot, *q*, in the forward end of the said bar, passes through a slot, *r*, (fig. 5) in the guide

Fig. 5.



bar, *g*, and rests against the back side of the front part of the said guide bar, which is of angular form. The bar, *N*, is arrested in its forward motion by the back part of the slot, *r*, coming in contact with the wedge, the height of which will therefore regulate its movement. When the wedge is raised so that its point only enters the slot, it will not arrest the bar at all; and consequently the latter then receives the full throw of the eccentric; but when the broadest part of the wedge is in the slot, the bar is pushed so far back, that the eccentric will scarcely act upon it at all, or the wedge may be made broad enough to stop the movement of the bar, *N*, entirely, and thus stop the feed. The parts are so adjusted, that when the proper quantity is being fed through the trunks, the mouth-piece, *k*, will, by means of the arms, *m m*, rod, *n*, and lever, *U*, hold the wedge such a height as to allow the bar, *N*, the proper movement necessary to give the feed rollers the required amount of motion every time they act, and should there be any increase in the quantity of feed, the mouth-piece will be raised, and cause the wedge to be depressed, and therefore lessen the length of the feed; the contrary effect being produced if the quantity of the feed decreases. The amount of the feed may be increased or decreased at pleasure, by altering the length of the rod, *n*, or by altering the distance of the wedge from the lever, *U*.—*Scientific American*, July 29th, 1854.

ART. V.—On the employment of Peat in burning Clay Pipes or Tiles.

By HENRY ANDERSON, Jun., of Ballynacree, Ballymoney, Co. Antrim.

THE importance of thorough draining has been for many years so fully appreciated, and the remunerative results have proved so very satisfactory to the agriculturist, that in the present progressive age, whilst foreign grain, both raw and manufactured, is admitted into our ports free from all duty, no land can be farmed with profit unless a liberal expenditure has been afforded it in drainage; hence we all feel the necessity of being able to accomplish this in the cheapest and best manner. Feeling satisfied that, even in districts where stones are abundant, tile-draining can be performed cheaper and in a superior manner if pipes or tiles can be obtained at a moderate rate, I now propose to state some results which may induce and enable interested parties to manufacture draining tiles or pipes in districts far removed from coal, where peat forms the local fuel.

My observations and experience in the use of this particular fuel have extended over a period of six or seven years, during which time I have seen several millions of pipes and tiles of all sizes burned, besides large quantities of brick; and, with the exception of one year, peat alone was used. About seven years since, my father, having purchased a property in the north of Ireland (County Antrim), soon discovered that, although the soil was of superior quality, little prospect could be entertained of obtaining even a very moderate return for the amount expended in purchase money, unless every acre was subjected to the operation of thorough drainage; he therefore immediately set to work, and as there was no tile manufactory in the district, stones were necessarily substituted; but as they had not only to be purchased, but also carted three miles, the expense was found so enormous as to preclude all hope of adequate remuneration. After minute inquiry regarding the cost of tiles in Scotland, as also careful calculations of the expense which their importation must incur, it became evident that draining could not possibly be effected under such disadvantages without a ruinous loss, whilst, were the land permitted to remain in its primitive condition, only medium crops could be expected. Under these circumstances, my father, being naturally desirous of obtaining reasonable interest for the considerable sum invested, and also anxious to set an example of improvement in agricultural matters (greatly needed in this neglected neighbourhood), resolved to attempt the manufacture of tiles on his own property, having observed clay which he believed suitable for this purpose in the stone drains then in progress of sinking. A portion of this clay was at once sent to a tile manufacturer in Scotland, which being soon returned in the form of excellent draining tiles, with a most satisfactory opinion of its capabilities from the burner, ere many weeks had elapsed a moderately sized work was erected, under the management of an experienced man from Scotland, who had spent nearly thirty years of his life in that occupation.

Since that period the works have been gradually augmented, proving in every respect most beneficial. Not only has nearly all the property on

which they stand been drained, but a considerable quantity of tiles has been disposed of to neighbouring proprietors.

The superintendent, never having used turf for tile burning, could not believe it suited for that purpose, and during the first year that the works were in operation, coal was imported from Scotland at considerable expense, but having been at length induced to try the native fuel, he ultimately confessed a preference for it, and all who have tested or seen the pipes and tiles produced under this system of burning admit them to be of superior quality. Feeling considerable interest in all matters connected with agriculture, since the erection of the works above mentioned I have directed my constant attention towards the entire process of manufacturing and burning tiles, as also the effects produced by different kinds of fuel, consequently I state nothing which does not result from personal observation.

The quality of peat naturally varies considerably in almost every district, but for the general understanding and determining those varieties best suited for fuel, suffice it to say, that in bogs hitherto undisturbed, where this vegetable deposit is yearly accumulating, the uppermost portion generally consists of that description usually termed "Flow," which varies in depth from 1 to 10 feet in different localities, and presents a soft, spongy, porous appearance, and on further examination it is found light, containing but a small quantity of matter capable of generating caloric, being from its open nature unable to sustain continued combustion. On the removal of this flow a substance much closer and denser becomes visible; the increased density arising, no doubt, from the greater length of time the deposit has existed, as well as the pressure caused by the superincumbent weight. When this variety of bog is carefully cut, dried, and especially if built into stacks, and allowed thus to remain for some months until entirely free from moisture, it forms a turf of sound quality, producing a good flame, and yielding a large amount of heat. The ash of this peat, as also that of flow, is light and white. The third and lowest deposit of a turf moss is still closer and denser, approaching much nearer coal, becoming hard, black, and weighty, when prepared for use in the manner above described, affording also a greater degree of heat; consequently it is preferred to either of the two former kinds by parties conversant with the relative value of turf. The ash remaining from this species is red, arising from its closer proximity to the clay.

In Ireland the use of turf as fuel is not confined to any particular district, its value being fully appreciated by most of the country manufacturers, who render it available in most of their public works, as also in the economy of domestic life; whilst to the poorer classes it proves a boon of no common magnitude, as during the process of preparation extensive employment is afforded them at a season when farming operations are light, whilst to all a cheap and cheering fire is secured during the cold and dreary nights of winter.

The most suitable method of using turf in the manufacture of tiles can briefly be stated, when it will be evident that in no degree does it differ from coal. At the commencement the fire must be applied slowly, until

whatever moisture yet remaining in the pipes has passed off, which is easily ascertained by observing when the steam ceases to escape from the kiln, which may be from twenty to thirty hours, according to the degree of dryness in which the pipes were when put into the kiln; after this the fuel is added more freely, increasing the quantity at each firing in proportion to the amount of heat required to burn the clay thoroughly. Some varieties of clay require more, some less; but this must be left to the judgment of the burner, who, it is supposed, understands the nature of the clay he is manufacturing. Care and close observation is very requisite, lest the heat may be too great or increased too rapidly, when melting would take place, as I have seen on one or two occasions. To attend the furnace of a large kiln, where turf is the fuel, more assistance is necessary than when coal alone is used, as the rapidity with which turf is consumed in so hot a furnace as that of a tile kiln causes the fires to require replenishing every twenty minutes or half hour. The time occupied in the operation, from its commencement to completion, is from fifty to sixty hours—sometimes three days; nor would I recommend too great haste in burning off a kiln, having seen a tougher and nicer article produced by allowing the fires a little extra time, the uppermost row being as well burned as those in more immediate contact with the fire.

As the relative cost of turf and coal must necessarily depend on various local circumstances, such as distance, mode of conveyance, value of the article, where produced, &c. &c., each individual must, of course, enter into these calculations for himself, but it may not prove uninteresting to give a brief statement of the difference in cost which exists in this district. Let us assume, then, that coals can be delivered at the works here, after paying freight and charges, land-carriage, &c., at 13s. per ton, either from the ports of Glasgow or Ardrossan, and the amount requisite for burning 25,000 2-inch pipes is 7 tons, thus costing £4 11s. per kiln, or 3s. 8d. per 1,000; while turf can be purchased at 6d. per gauge (a measure of 3 feet square), and 120 gauges, or £3 worth, are required to burn a kiln of equal size, thus showing a saving in favour of turf of 30s., or upwards, on every 25,000 pipes, and nearly 1s. 3d. on every 1,000 pipes, which, in an article of large consumption and small value, is well worthy of consideration—to which may be added the facility of obtaining a ready supply of the fuel; whereas, early in spring, it is both inconvenient and difficult to import coals from Scotland, and at that season freights are higher, further adding to the cost of coals.*

As any kiln constructed for coal fuel will be found equally suitable for the use of turf, a few words on the subject of kilns best suited for turf will suffice. The first kiln erected at our works is capable of containing 25,000 2-inch pipes, and is similar to those used in the midland shires of Scotland, from which locality the plans were procured. As the works increased, another kiln was built capable of holding 20,000, and which exactly re-

* If so large a saving can be effected where coals cost only 13s. per ton, it must be evident that the use of turf must be highly advantageous in the west and midland districts of Ireland, where coals are now very expensive.—Ed.

sembles the common riddle kiln of Scotland, with this slight difference, the furnace bars extend wholly across the kiln, instead of being, as is usually the case, only 2 feet in length; and trivial as this alteration may appear, most beneficial effects have been produced, greatly facilitating the process of burning, as the enlarged space thus afforded for the entrance of air materially increases and equalizes the draught, and thus prevents the turf from becoming coated with ash, which invariably retards the process of burning.

The two fuels may, however, be used conjointly with beneficial results. Indeed, the burner here would be disposed to fire his kiln with coals for the last three or four hours, provided they were as cheap as turf; but my own opinion is, that this desire on his part arises wholly from a wish to save himself some of the extra labour and strict attention which is necessary when turf is used.

In my anxiety to compress the preceding observations regarding the use of turf as fuel into a brief space, I have not referred to the many other cases where it supplies the place of coal, but may state that it is used for economy in firing the ten-horse-power steam-engine erected on this farm, for thrashing, oat-bruising, straw-cutting, &c. &c.

In conclusion, I have only further to remark, that it will be to me a source of sincere gratification if the information I have attempted to convey should prove the means of inducing landed proprietors (residing in districts where turf is abundant) to erect tile manufactories, which hitherto they may have been deterred from attempting in consequence of the absence or high price of coal.—*Prize Essay in Transactions of the Highland and Agricultural Society of Scotland.*

ART. VI.—*On two processes for the Preparation of Aluminium, and on a new form of Silicium*, by H. SAINTE-CLAIRE DEVILLE.

M. DEVILLE has read to the Academy of Sciences a continuation of his researches on aluminium, (see notice of his former communication in No. IV., p. 110, of this Journal,) and exhibited to its members large slips of this curious metal, and also some large medals struck in the French Mint from it, which appear to have excited universal admiration. Nothing could be more astonishing, certainly, than to handle pieces of a metal existing in common clay, having all the brilliancy of silver, and yet only as heavy as glass. M. Sainte-Claire Deville has not, however, confined his researches to aluminium, but has also succeeded in obtaining silicium, a substance even still more abundant in nature than aluminium, in a very peculiar form, and with properties which seem to hold out a hope that it may also become useful in the industrial arts. The subject is so important and interesting, that we shall give the substance of M. Deville's paper here, and to a great extent in his own words.

"I have the honour to present to the Academy the continuation of a work undertaken and carried on with an object altogether scientific, but the results of which, confirmed by new experiments, have again conducted me to the same practical conclusion. Aluminium, of which the commonest clays may contain 25 per cent. of their weight, is eminently adapted to become a useful metal. I had not published the methods which I had employed to produce it; they required to be controlled by experiments still made on a small scale, it is true, but which I

could not try with the funds allocated to my laboratory at the *Ecole Normale*. I owe it to the Academy to have been able to realize these experiments, and I here express to it my gratitude.

"Before entering upon the subject of this note, I must state that everything which I had announced at the conclusion of my first study, has been verified and confirmed since I possessed aluminium in pretty considerable quantities. The medals of large size which I have had struck, the plates which I place under the eyes of the Academy, have not undergone any alteration in the air; the small ingots have been handled each day, during many months, without losing their brilliancy. Finally, this substance is so unoxidizable, that it resists the action of the air in a muffle heated to the temperature required for gold assays; in a cupel, lead burns, the litharge melts by the side of the aluminium, which loses none of its properties. If this metal alloyed itself with lead, it could evidently be expelled.

"Aluminium conducts electricity eight times better than iron, and consequently, as well, if not better, than silver.

"The place among the metals which should be given to aluminium, in accordance with the principles of classification of M. Thenard, ought to remove it from magnesium, zinc,* and manganese, alongside which it is now placed. It should be made the type of a very natural group, composed of itself, chromium, iron, nickel, and cobalt. They have a common character, to which I attach, in a theoretical point of view, the greatest importance; they are not attacked by weak or concentrated nitric acid, in the presence of which they become *passive*. Passivity, very energetic in the case of aluminium and chromium, the protoxides of which (if there is one of aluminium) have an ephemeral existence, is only manifested in iron in concentrated nitric acid, where the production of protoxide is impossible; it is only very feebly exhibited in the case of nickel and cobalt, the sesqui-oxides of which are unstable, and only enter with difficulty into combination. The two latter metals establish the passage to manganese. I shall return at a future period to these analogies, which give a new idea of the phenomenon of passivity, at least of the chemical part of it.

"Aluminium, like iron, does not alloy itself with mercury, and takes up, with difficulty, some traces of lead; it produces with copper light alloys, which are very hard and very white, even when the copper enters into the composition of the alloy to the extent of 25 per cent. Its most distinguishing characteristic is its property of forming with carbon, and especially with silicium, a grey, granular, brittle, fusible, metallic mass, (corresponding to pig iron,) which is crystallizable with great facility. The planes of cleavage intersect at angles which appear to be right. If this cast metal be attacked by hydrochloric acid, the stinking odour of the evolved hydrogen will indicate the presence of carbon. But that which it especially contains is silicium, which may be separated in a state of purity by the prolonged action of boiling concentrated hydrochloric acid. It appears to me that the silicium exists in the cast aluminium, in the same condition as the carbon in grey pig iron, a condition as yet but little understood, but upon which my researches on aluminium will permit me, I hope, to throw some light.

"This silicium is in the form of brilliant metallic scales, completely similar to grains of platinum, and in this form it differs essentially from the silicium of Berzelius. I do not, however, believe silicium to be a true metal; on the contrary, I consider that this new form of silicium is to ordinary silicium what graphite is to carbon. This body possesses all the chemical properties which

* "I would place zinc alongside magnesium; in the first place, zinc sensibly decomposes water at 100° (centigrade); and then, notwithstanding the common opinion, pure oxide of zinc is not reducible by hydrogen, in the midst of which it volatilizes, forming a mass of crystals, in which the rhombohedral terminations of oxide of zinc are seen. I published two years ago an analytic method, founded upon this property of zinc, which M. Debray has since verified by numerous experiments made in the laboratory of the *Ecole Normale*; he has besides seen that oxide of zinc resists the reducing action of Marsh gas, in the midst of which it completely volatilized."

Berzelius attributes to the residue of the incomplete combustion of ordinary silicium, but is still more unalterable. Thus, to give an idea of this indifference to the action of the most energetic reagents, the new silicium which I have the honour to exhibit to the Academy, has been heated to a white heat, in a current of pure oxygen, without changing its weight, (and without giving off carbonic acid, like the carburet of silicium,) that it has resisted the action of hydrofluoric acid, and it only dissolves in a kind of *aqua regia* formed of hydrofluoric and nitric acids. Fused potash transforms it into silica, but the operation takes a long time to complete. Silicium conducts electricity like graphite.

"The raw aluminium from which I extracted the silicium, contained more than 10 per cent. of it. It appears that in order to produce this raw aluminium, the silicium should be in the nascent state at the moment of the combination, for aluminium melted in a clay crucible attacks the sides,* gives rise to the formation of silicium, but does not unite with it; the metal preserves all its malleability, and there is found in the crucible a chocolate powder, nearly identical with the silicium of Berzelius. We shall see subsequently that this raw metal is the first product which results from the action of the battery on the chloride of aluminium, and on the chloride of silicium, which always exist together in the impure substances which are usually submitted for decomposition.

"I shall only give in this note two modes of preparation, the only ones which I know well, and which I have often practised.

"1. *Process by means of Sodium*—From 200 to 300 grammes (3,086.8 to 4,630.2 grains) of chloride of aluminium are to be introduced into a large glass tube, from 3 to 4 centimetres (1.18,113 to 1.57,484 inches) in diameter, and well isolated between two plugs of asbestos. Hydrogen, well freed from air and quite dry,† is introduced by one end of the tube. In this current of gas the chloride of aluminium is to be heated by means of some charcoal, so as to drive off the hydrochloric acid of the chloride of silicium, and the chloride of sulphur, with which it is always impregnated. A number of small boatlike trays, as large as possible, and each containing some grammes of sodium, (1 gramme = 15.434 grains,) previously crushed between two leaves of perfectly dried filtering paper, are then introduced into the tube. The tube being full of hydrogen, the sodium is melted, and the chloride of aluminium heated, which distils, and is decomposed with incandescence, which may be readily moderated to such a point as to be rendered null if desirable. The operation is terminated when the whole of the sodium has disappeared, and that the chloride of sodium formed has absorbed sufficient chloride of aluminium to be saturated. The aluminium is then immersed in the double chloride of aluminium and sodium, a very fusible and volatile compound. The small boatlike trays are then withdrawn from the glass tube, and introduced into a large porcelain tube furnished with a recipient, and traversed by a current of dry hydrogen free from air. The tube is heated to bright redness; the chloride of aluminium and sodium distils without decomposition, and collects in the recipient; and when the operation is completed, the whole of the aluminium will be found collected in the boats, one or two large globules at most in each. These are to be washed with water, which removes a little more salt, having an acid reaction and some brown silicium. In order to make a single ingot of all these globules, they are to be introduced, after having been washed and dried, into a porcelain capsule, in which some of the distilled product of the previous operation is put as a flux, that is, some of the double chloride of aluminium and sodium. The capsule is then to be heated in a muffle, to a temperature close to the melting point of silver at least, when all the globules will be seen to unite into one brilliant button, which is allowed to cool, and is then washed. It is necessary, however, to keep the metal in a state of fusion in a covered porcelain crucible, until the vapours of the chloride of aluminium and

* "I now prepare crucibles, which are infusible and inattackerable, from alumina rendered plastic by means of gelatinous alumina."

† "For this purpose the gas is passed through a bulb filled with spongy and black platinum, and gently heated. The gas is subsequently dried with soda-lime."

sodium, with which the metal always remains impregnated, have entirely disappeared. The metallic button is found enveloped by a thin pellicle of alumina, produced by the partial decomposition of the flux.

"It is easy to understand that the sodium may be replaced by its vapour, which is easily produced, and the aluminium be obtained in an economical manner, even in employing an alkaline reducing agent. But I shall return at a subsequent period to the consideration of the modification which should be made in the apparatus by which this process could be rendered applicable.

"2. *By the Battery.*—Hitherto it appeared to me impossible to obtain aluminium in aqueous liquors by the action of a voltaic battery. I would even believe in its absolute impossibility, if the brilliant experiments of M. Bunsen on the production of Barium had not shaken my conviction. Nevertheless, I think it right to add, that all the processes of this kind for the preparation of aluminium which have been recently published, have not given me any result.

"It is by means of the double chloride of aluminium and sodium, ($\text{Al}^3 \text{Cl}^3, \text{Na Cl}$)* of which I have already spoken, that this decomposition is effected. The aluminium bath is prepared by taking two parts by weight of chloride of aluminium, and adding to it one of dry pulverized common salt. The whole is mixed in a porcelain capsule heated to about 200° (centigrade). The combination is soon effected with a disengagement of heat, and a very fluid liquid, at a temperature of about 200° , at which temperature it is fixed, is obtained. This is introduced into a glazed porcelain crucible, maintained at a temperature of about 200° by means of some charcoal. The negative electrode is a plate of platinum, upon which the aluminium mixed with common salt deposits in the form of a grey crust. The positive electrode is formed by a perfectly dry porous vessel, containing fused chloride of aluminium and sodium, in which is immersed a cylinder of charcoal,† which conducts the electric current. It is to this point the chlorine comes, and also a little chloride of aluminium formed by the decomposition of the double salt. This chloride would volatilize and be a pure loss, if some common salt were not put into the porous vessel. The fixed double chloride becomes re-constituted, and the fumes cease. A small number of voltaic elements (in case of need, two will be sufficient) only are necessary to decompose the double chloride, which, indeed, offers but a feeble resistance to the electricity.

"The platinum plate is removed when it is sufficiently charged with the metal-liferous deposit. It is allowed to cool, the saline mass broken rapidly, and the plate again introduced into the circuit. The rough material detached from the electrode is fused in a porcelain crucible enclosed in another of fire clay. When cold it is to be treated with water, which dissolves a large quantity of common salt, and leaves a grey metallic powder, which is united into a button by several successive fusions, the double chloride of sodium and aluminium being used as the flux.

"The first portions of the metal obtained by this process are almost always brittle, it is the raw cast metal of which mention has been made above. A metal can, however, be obtained equally fine by the voltaic battery as by means of sodium; but in order to do so, it is necessary to use a much purer chloride of aluminium; and in fact, the silicon, the sulphur, and even the iron, which passes into the condition of a fixed proto-chloride, at the temperature at which the operation is effected, are removed by means of the hydrogen in the sodium process, whilst all those impurities remain in the liquid, which is to be decomposed by the battery, and are removed with the first portions of the metal reduced."—*Comptes Rendus de l'Academie*, 14th of August, 1854, p. 321.

* "This interesting substance which represents the spinelle with a base of soda, in which the oxygen is substituted by chlorine, is the type of a great number of analogous bodies, in the study of which I am now engaged, for the purpose of comparing them with the oxide minerals, from which they differ only by the substitution of chlorine for oxygen."

† "The most dense charcoal dissolves very rapidly in the bath, and falls to powder, hence the necessity of a porous vessel."

ART. VI.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

Hydro-Pneumatic Battery.—Signor Agostino Carosio, a physician of Genoa, has invented what he calls a hydro-pneumatic battery, which he proposes to use as a motive power. His apparatus consists of a gas battery on the principle of Grove's, that is, a number of voltaic elements in which oxygen and hydrogen gases by their combination to form water, develop an electric current. This current is conducted into a series of cells containing acidulated water, which is rapidly decomposed; the evolved gases, oxygen and hydrogen, being kept separately, are collected in two reservoirs, where their accumulation gradually develops a pressure of several atmospheres. From these reservoirs the gases are introduced in the same manner as steam or sur-heated air into two cylinders with pistons, the one for the oxygen being only half the size of that for the hydrogen. The gases having done their work and expanded into the volume which they should have under the ordinary pressure of the atmosphere, their temperature being considerably reduced in consequence of this expansion, pass into two other reservoirs, where they regain their normal temperature by the contact of the air with the vessels. From the latter reservoirs the gases then flow into the gas battery to supply the place of what are continually converted into water. We have accordingly a kind of perpetual motion, and certainly the nearest approach that has yet been made to the solution of that fond dream of imaginative inventors. Dr. Carosio has not, however, solved it, for there is a certain loss of power from the resistance to the passage of the electric current, in conducting wires, &c.; and this loss is compensated for by the addition of a few ordinary cells to decompose water enough to produce the supplementary gas required. Extraordinary results are anticipated from this invention, and certainly, if it is at all successful, it would go far to revolutionize navigation by means of vessels propelled by power, and would be of the greatest importance to countries without coal. Connected with this invention is a fact which speaks well for the patriotism and rapidly growing enterprise of Italy. A society, called *Società dell'invenzione Carosio*, has been formed for working the patents which Dr. Carosio has secured in different countries, with a capital of £100,000, £40,000 of which are to be allocated to the inventor. This society was founded in March, 1853, and the whole of the shares were subscribed for almost immediately, as a question of patriotism. A laboratory and a workshop were at once organised, and the services of Mr. Siemens, an English engineer, (well known for his improvements in the electric telegraph and water metres,) secured. A great number of experiments have been made, both of practical and scientific importance, and if we are to believe the statements of the projector, no doubt can now exist as to the entire practicability of the experiment, although many eminent scientific men consider it utterly impracticable.

PROCESSES CONNECTED WITH FOOD, RURAL ECONOMY, AND AGRICULTURE.

Means of removing the Rancidity of Butter.—Wild recommends that the butter should be kneaded with fresh milk, and then with pure water. He states that, by this treatment, the butter is rendered as fresh and pure in flavour as when recently made. He ascribes this result to the fact, that butyric acid, to which the rancid odour and taste are owing, is readily soluble in fresh milk, and is then removed.—*Pract. Universal Rathgeber, through Pharmaceutical Journal, January, 1854.*

On the relative Composition of the different Fishes used as Food, by M. M. Payen and Wo'd.—The following results will be interesting to many of our readers, not only in reference to the relative nutritive values of different edible fishes, but also in connexion with the important subject of the manufacture of an artificial manure from refuse fish, which we have already on two occasions noticed in this Journal (see article on this subject in No. I., p. 7, and notice of the process of M. Molon, No. IX., p. 279).

Table showing the relative Composition of several Edible Fishes.

Name of Fish.	Water.	Solid Matter.	Fat.	Mineral Matter.	Nitrogen.
Skate,	75.489	24.511	0.472	1.706	3.846
Conger Eel,	79.909	20.091	5.021	1.106	3.172
Cod, Salted,	47.029	52.971	0.383	21.320*	5.023
Herrings, Salted,	48.998	51.002	12.718	16.433†	3.112
Do. Fresh, ‡	70.000	30.000	10.300	1.900	2.450
Whiting,	82.950	17.050	0.383	1.083	2.416
Mackerel,	68.275	31.725	6.758	1.846	3.747
Sole,	86.144	13.856	0.248	1.229	1.911
Common Dab	79.412	20.588	2.058	1.936	2.898
Salmon,	75.704	24.206	4.849	1.279	2.095
Pike,	77.530	22.470	0.602	1.293	3.258
Carp,	76.968	23.032	1.092	1.335	3.498
Barbel,	89.349	10.651	0.212	0.900	0.571
Gudgeon,	76.889	23.111	2.676	3.443	2.779
Bleak	72.889	27.111	8.134	3.253	2.689
Eel,	62.076	37.924	23.861	0.773	2.000

A better idea can be formed of the differences which exist between the proportion of fatty constituents which these fish contain from the following table, which represents the proportion of oil or fat which 100 parts of each of the dried fish contain:

Eel	62.92	Bleak	3.00
Herrings	34.35	Whiting	2.83
Conger	24.99	Pike	2.67
Salt Herrings	24.90	Barbel	1.99
Mackerel	21.30	Skate	1.92
Salmon	20.10	Sole	1.79
Common Dab, or Salt-water Fleuk	10.00	Cod	1.14
Carp	4.74	Cod (Salted)	0.72

The consistence of the fatty constituents in these fish differs also very considerably, the most abundant being the perfectly fluid or oily, and the least the solid. They may be classified as follows in the order of their fluidity:—*Oils*—1, freshwater eels; 2, herring; 3, bleak; 4, mackerel; 5, conger; 6, salmon; 7, gudgeon. *Semi fluid*—1, pike; 2, carp; 3, common dab. *Solid fat*—cod, whiting, sole, skate, and barbel. The large quantity of fatty matter which the eel contains is a curious fact. It is certainly remarkable that nearly two-thirds (about 63 per cent.) of the solid substance of the flesh of an animal should be formed of a brown fluid fat body, and yet that no distinct fatty tissue can be recognised by the naked eye.

MM. Payen and Wood endeavoured also to ascertain whether any notable differences of chemical composition existed between the tissues of the different fishes, and with this view submitted the flesh, freed from fat and dried, of four which varied most in this respect. The differences were chiefly apparent in the proportion of carbon, as will be seen from the following table, which contains a summary of the results:

	Eel.	Mackerel.	Sole.	Barbel.
Carbon,	52.899	51.515	48.795	45.927
Hydrogen,	7.474	6.902	6.581	6.800
Nitrogen,	14.644	15.836	15.460	15.535
Oxygen,	19.296	19.608	20.032	22.783
Ash,	5.687	6.139	9.132	8.955

* Of this 21.320, per cent. of mineral matter, 19.544 was common salt.

† Of this 16.433 per cent. of mineral matter, 14.623 was common salt.

‡ Composition deduced by an approximate calculation from that of fresh herrings.

The great variation in composition which the different fish present, would seem to explain why certain fish produce serious gastric derangements when they form part of the food of some persons, while many other fish produce no such effect. There must undoubtedly be great difference of action upon the organs of digestion between such fish as the sole or the barbel, which contain in their natural state less than $2\frac{1}{2}$ parts in 1,000 of a consistent fat, and the eel, which contains 232 parts, or one hundred times more of an oily fat.—*Des substances alimentaires et des moyens de les améliorer, de les conserver et d'en reconnaître les alterations.* 8vo. pp. 329, 2nd ed.; through *Comptes Rendus de l'Académie*, 14th August, p. 318.

ART. VIII.—*Bulletin of Industrial Statistics.*

COMMERCE OF THE SANDWICH ISLANDS.

Imports.—The total amount of imports for 1853 has exceeded those of 1852, by 522,082,064 dollars. From the United States they amounted to 954,919,093 dollars, which is more than three-fourths of the whole amount imported. The following are the imports for the past four years:—

			Dollars.	Cents.
1850	...	...	1,035,058	70
1851	...	...	1,823,821	68
1852	...	...	759,868	58
1853	...	...	1,281,951	18

Giving an average for the four years of 1,225,175 02. The amount of imports for 1853 exceeds the average of the past four years by 56,776,16 dollars.

Foreign Exports.—*Comparison for four years.*

			Dollars.	Cents
1850	...	...	46,529	72
1851	...	...	381,402	55
1852	...	...	381,143	51
1853	...	...	191,397	66

Domestic Exports.—

Dollars.			Cents.	Dollars.			Cents.
1850	...	596,522	63	1852	...	638,395	20
1851	...	309,828	94	1853	...	275,374	17

Revenue.—

1850	...	121,506	73	1852	...	113,091	93
1851	...	160,602	19	1853	...	155,640	17

Vessels Arrived.—

		1850.	1851.	1852.	1853.
Merchant	...	469	446	235	194
Whalers	...	237	135	519	535

Of the whale ships some have touched at two or more ports, consequently the number of different vessels are not so great as the figures seem to show. The preceding tables show the great lack of a domestic export to anything like the amount of our imports, and calls for some renewed efforts to create or increase it. An export is now the great desideratum.

Value of Goods Imported into the Sandwich Islands during the year 1853.

			Dollars.	Cents.
Liabie to duty	...	...	1,160,355	13
Duty free	...	...	79,402	80
Entered in bond	...	...	16,284	35
Withdrawn for consumption			25,908	90
Total	...		1,281,951	18

Of the goods liable to duty, 587,770.29 dollars' worth were from the Atlantic side of the United States, and 367,149.64 dollars' worth from the Pacific side, in all, 954,919.93 dollars from the United States. The country from which the next largest amount of goods was imported is China, from which the imports only amounted 42,056.36 dollars; from Chili, 38,099.30 dollars; Great Britain, 20,471.74 dollars; Bremen, 12,225.91 dollars; Philippine Islands, 12,038.57; France, but 30 dollars.

Receipts from Customs in 1853.—The total duties received at Honolulu was 146,964.52; at Lahaina, 8,138.27; all other parts, 537.38. Total in the kingdom, 155,640.17 dollars.

Of the total receipts 58,114.86 were for duties on goods; 70,209.68 on spirits; and 8,361.75 for harbour dues.

Export of Domestic Produce in 1853.—The total value was 281,599.17 dollars, the chief items of which were as follows:—

Sugar ...	lbs. 634,955	Goat skins ...	5,600
Syrup ...	gallons 18,244	Hides ...	1,741
Molasses ...	" 58,448	Cocoa nuts ...	2,000
Coffee ...	lbs. 50,506	Tallow ...	lbs. 16,452
Salt ...	bushels 3,509	Wool ...	" 10,824
Irish potatoes ...	" 15,464	Melons ...	" 2,500
Sweet potatoes ...	" 8,979	Fresh beef ...	lbs. 38,000
Pigs ...	" 3,724	Salt beef ...	13,260
Sheep ...	" 733		

Of the total of 281,599.17 dollars, but 154,674.17 was really exported, the remainder, 126,925, having been furnished as supplies to the 154 merchant vessels and 246 whalers that stopped at the Island.

Oil and Bone transhipped free of duty in 1853.—Spring Season.—

	Sperm Oil. Gallons.	Whale Oil. Gallons.	Whalebone. Pounds.
To United States ...	132,251	1,897,116	435,846
To Havre ...	476	37,038	22,000

Fall Season.—

To United States ...	42,669	1,853,194	1,520,559
To Cowes, England ...	...	...	21,040
To Bremen ...	...	...	14,819
To Havre ..	...	...	6,000

Total .. 175,396 3,787,348 2,020,264

Arrival of Merchant Vessels in 1853; their Nationality.—The total number of merchant vessels that visited the Islands in 1853 was 211, of whom—

Arrived at Honolulu ...	154	Arrived at Waimea ...	8
At Lahaina ..	29	At Kealakeakua ...	9
At Kawaihae ...	10	At Hilo ...	1

Of these vessels, 137 were American, with a total tonnage of 45,234; 17 Hawaiian, tonnage, 2,672; 32 British, tonnage, 6,185; 5 Danish, tonnage, 866; 5 French, tonnage, 1,034; 3 Russian, tonnage, 1,223.

Arrival of Whalers and their Nationality.—During the same year arrived 535 whalers, viz:—

At Honolulu ...	246	At Kealakeakua ...	12
At Lahaina ...	177	At Kawaihae ...	20
At Hilo ...	66	At Waimea ...	12

Of the total, 500 were American, 19 French, 12 Bremen, and 4 Russian.

Coasters.—The total number of vessels engaged in coasting among the Islands is 32, with a tonnage of 1,338.

THE

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No. XI.—NOVEMBER, 1854.

ART. I.—*On the recent Improvements in the Construction of Ovens for Baking Bread; and on the different Experiments recently made to determine the relative Quality of different Breads, &c.*

“A DAY will doubtless come when our descendants, who shall read the technology of the nineteenth century, will ask themselves, if at this epoch of industrial progress we prepared the chief of our aliments by the rude way which we now witness—in plunging the arms into the dough, lifting it up and crushing it down with such efforts that they exhaust the energy of the half-naked arms, and make the perspiration run down into the food. If, truly, at that time the baking was effected in the very hearth itself from whence the coal and the cinders had just been almost withdrawn. If it should be believed that during these fatiguing operations the chief part of the heat appeared destined to heat beyond measure, to roast we might almost say, the workman, rather than to bake the bread.” If this quotation, from a report read to the French Institute by M. Payen, in the name of a commission composed of MM. Poncelet, Boussingault, and himself, be applicable to France, how much more so is it to our circumstances.

We may say, without fear of exaggeration, that in all that concerns the preparation of food, we in Ireland are perhaps below every nation in Europe. We do not speak here so much of the wealthier classes as of the working people, whose social misery is considerably increased by the total disorganisation which prevails in their domestic economy. To such an extent is this the case in Dublin, for example, that skilled artisans often prefer lower wages in Manchester, Bradford, &c., than in Dublin, in consequence, not so much of the absolute price of provisions being higher in Dublin, but because among several other causes, in their retail, the peculiar circumstances of the working classes are utterly lost sight of. Even in Great Britain, where such gigantic strides have been made in all branches

of manufacture, it is singular how little progress comparatively has been there effected in the economical preparation of articles of food, as, for example, in the baking of bread. In illustration of this, we may point to the fact that, while the French miller purchased largely of corn in our markets last year, wheat having been at that time cheaper in these countries than in France, the price of bread was much lower in the latter country than here.

The extraordinary disproportion which always appears to exist between the price of bread and the price of wheat has often struck us, and led us to seek for the cause. Among those which presented themselves most strongly to our notice was the imperfect and expensive process of manufacture in common use. The preparation of the dough is very imperfect—indeed we might almost say it is barbarous—and the waste of labour enormous. But the operation of baking is still more objectionable, not alone on account of the great expenditure of labour, but also because it exhausts the strength and shortens the life of the workmen. Many attempts have been made from time to time to substitute machinery for human labour, and thus render the manufacture of bread at once more economical and salubrious. Except in the manufacture of ship biscuit, such as it is carried on at Portsmouth, these attempts have not been hitherto very successful. We are now, however, about to bring under the notice of our readers at least one exception which has been eminently successful—namely, the kneading-trough and oven of M. Rolland, a baker of Paris.

M. Rolland's Kneading-Trough and Oven.—M. Rolland's system was made the subject of a highly laudatory report to the French Academy of Sciences, in June, 1852, by the Commission already mentioned, and since then the company formed to work the project have set up ovens upon this system in Italy, Austria, Bohemia, Hungary, Belgium, Spain, Holland, Switzerland, Piedmont, in Africa, America, and even in Oceania; and has sold its patents for Sardinia, Austria, Spain, and the exclusive privilege of working the system in Algeria and in thirty departments of France; and finally, during the first seven months of this year, it realised a net profit of 230,000 francs (£9,200). It is strange that such a successful system should not be adopted in these countries, for we have been unable to ascertain the existence of even one of them. The company sent nicely executed models of its oven and kneading-trough to the Dublin Exhibition of 1853, but they attracted no attention, having had the misfortune to be placed in a rather out of the way place. We wrote a short notice of them at the time for a publication, but it was not published. We shall now, however, direct the attention of the public to the system, and hope to be able before long to present our readers with engravings illustrative of it.

The kneading-trough, which resembles in some degree those already invented—such as the one invented by a baker of the name of Fontaine, and improved by M. Moret, and the other by another baker and very ingenious man, M. Boland—consists of a semi-cylindrical trough, provided with a semi-cylindrical cover, which may be attached to the wall. A horizontal axis works in the trough in gudgeons supported by the ends of the trough

itself. This axis has two curved wings, or rather frame-works, the whole length of the trough, attached in opposite directions, the curvatures being also in opposite directions. These wings consist of parallelograms of wood, of which the axis forms one side, with a number of curved cross bars radiating from the axis; between each of these bars is a short bar, only half the length of the first, and attached to the outer side of the parallelograms, with its point directed towards the axis. This agitator is set in motion by a large toothed wheel, working in a pinion, and moved by a handle. Such a machine, requiring less force than that of a man, will work up dough to supply the repeated batches of a continuous oven 13 feet in diameter. A sack of flour may be worked into a perfectly homogeneous, perfectly fermented and aerated mass of dough in 20 minutes, or, if necessary, even in 15 minutes. It is thus simple and economical, and does away completely with the laborious and disgusting operation of kneading the dough by the hands or feet as usually practised.

The oven of M. Rolland combines a number of advantages found isolated in the inventions of others. The oven is circular; its floor consists of plates of cast-iron covered with tiles, and is supported upon a vertical axis capable of moving in a collar and socket. The latter is capable of being moved up and down by means of a vice screw, so as to increase or diminish the height of the oven space according as the bread to be baked is in large or small loaves. By means of a bevelled pinion upon the vertical axis gearing with another fixed upon a horizontal axis, which is capable of being set in motion by means of a pulley fixed upon its other end, and connected by a Vaucanson chain with another moved by a handle, the floor may be made to revolve at the will of the workman. The idea of constructing an oven with a revolving floor was first proposed by the Count Chabrol de Volvic and Legallois, for the use of the French army, but was abandoned from the difficulty of regulating the heat.

Rolland's oven is heated by means of a fire-place built in the masonry under the revolving floor. The smoke and heated air passes by vents and six cast-iron pipes radiating upon a slightly inclined flooring of tiles, and thus heats the floor of the oven; from these horizontal flues the smoke passes up through a corresponding number of vertical flues, and thus heat the wall of the oven. These vertical flues discharge into an open space between the cast-iron roof of the oven and a second plate, which is covered with a thick layer of cinders or other bad non-conducting material, and from this space it passes off by means of a chimney. M. Rolland's oven is thus heated like a muffle, but without direct contact with the fire. Many other ovens heated by means of hot air have been proposed at different times, such, for example, as that of Mr. Coveley, which is still in use, and which has also the peculiarity of having four floors or platforms, which are made to move up and down, like one of those machines at fairs provided with seats which are made to revolve vertically; in this way each floor may be brought opposite the door, and the heat of the whole oven equalized by the motion. Another aërothermal oven, which was invented before that of M. Rolland, was that of Lemare and Jamatel, which was considerably improved by MM. Grouvelle and Mouchot. The system of arrangement

adopted in the construction of the flues in M. Rolland's oven are, however, far more effective than in any preceding system. The economy of fuel effected by this system over the common oven is perhaps more than 50 per cent., and any kind of fuel, wood, turf, coal, or coke, may be employed.

In charging such an oven the floor is made to revolve by means of the mechanism above described, so that each part is brought opposite the door, so as to enable the workman to arrange the loaves in lines, and thus economise every inch of vacant space. This may be done rapidly and without much labour, for instead of the long *peels* with which the baker had to stand opposite the highly heated oven, a short one of 6 or 7 feet is sufficient for an oven 13 or 14 feet in diameter; an oven of this size may be charged in one-fifth of the time required to charge a common one. When the oven is charged and the door is closed, the interior of the oven can be observed by means of a peep glass in the door and a jet of gas, the light of which is thrown into the oven by means of a reflector; by causing the floor to revolve, each loaf of bread may be passed in review, and its exact condition carefully examined. If the heat be too high in one part of the oven or too low in another, the position of the loaves may be changed by revolving the floor.

Such an oven, as may at once be seen, is perfectly continuous; while one batch is being withdrawn, the oven regains the temperature necessary to bake another, which may be almost immediately introduced. As a batch is usually baked in from 20 minutes to half an hour, from 18 to 20 batches of bread, made in the form and size of French loaves, may be baked in 24 hours; a batch of bread made into loaves similar to those made here would of course take longer, and a fewer number could consequently be baked in 24 hours. In order to have full control of the heat, the exact temperature can always be ascertained by means of a thermometer fixed near the door; and if the oven should become too hot, the draught of the flues can be diminished or diverted by means of a damper.

M. Rolland has introduced another excellent improvement, namely, doing away with the necessity of dusting over the fresh formed loaves with flour in order to prevent their adherence to the peel or the oven. This dusting with flour, besides often communicating an unpleasant taste to the bread, is frequently the cause of alteration, and especially of the development of fungi or mildew. By causing a current of warm air to come in contact with masses of dough after they have been fashioned into the desired forms, he produced a slight dry pellicle, sufficient to prevent their adherence, and enable them to glide off the peel or on the floor of the oven.

The bread made by Rolland's system is of singular uniformity of character when flour of the same quality is employed; it is considered to be well worked in the dough, exceedingly well baked, and sweet tasted. None of the loaves are found with a burned crust; indeed it is almost impossible to distinguish one loaf from another, so exactly similar are they in colour.

The following are the advantages which the Commission of the Institute consider the system of M. Rolland to have already realised in several bakeries over the old methods:—

1. Clean, healthy, regular, and noiseless kneading, by means of a simple and inexpensive kneading machine.

2. Easy introduction and withdrawal of the batch with very short and manageable instruments.

3. The employment of any fuel indifferently.

4. Considerable economy of fuel.

5. Suppression of the disagreeable and unhealthy sweeping of the floor of the oven after each operation.

6. Regularity of baking and facility of managing it.

7. Production of loaves free from all trace of ashes or flour, and of the most excellent quality, good appearance, and perfectly clean.

That all these advantages have been still further realised since the period of that report, the successful operations of the Society for the Establishment of the Rolland Bread-Making Apparatus in every part of the world, except in these countries, as we have already mentioned, fully testifies.

This system presents peculiar advantages for producing bread in large establishments or for large bodies of people, and would therefore be well adapted for barracks, workhouses, large schools, and colleges. And from the rapidity with which a large quantity of bread may be produced with it, we have no doubt that its introduction would greatly contribute to do away with the night work of bakers, that worse than negro slavery. We hope to see it introduced by some enterprising person, and the present barbarous and disgusting system in time superseded by this or some other improved method.

M. Carville's Oven.—Another continuous aërothermal oven has been in operation in France within the last few years, the invention of a M. Carville, a baker of Alais, in the department of Gard. Like the one just described, it is a kind of muffle heated all round by the flames and heated air, but the floor is fixed. This floor is circular, and is double, with a slight space between each, the material employed being thick earthenware tiles. This double floor is supported on a number of pillars of fire clay. The flames and heated air pass directly from the fire-place, which is at the opposite side to that of the door of the oven, and sweep under the floor, after which they pass up by a circular vertical flue around the oven, into an arched chamber formed by the roof of the oven, properly speaking, and a second arched roof. This chamber is subdivided by a number of partitions radiating from the centre, so as to form a number of small compartments. In the centre where they meet is a flue which passes upwards through the arched roof into another chamber. Where each of the small compartments formed by the partitions just mentioned opens upon the central flue, there is a valve or damper, by which the smoke may be shut off from one or more compartments, so as to enable the temperature of the oven to be regulated according as it may be required. From this partitioned chamber the smoke passes into the upper chamber already mentioned, which consists of a spiral flue terminating in a chimney. This long spiral flue fills the same office in M. Carville's furnace as the layer of cinders in M. Rolland's, namely, to maintain the heat in the chamber over the roof of the oven.

Six tubes provided with cocks are inserted into the masonry, two of which enter into the muffle or oven, properly speaking, at the side opposite the door; the other four penetrate only to the circular vertical flue surrounding it. By opening the cocks of these pipes the vapour produced by the bread can escape; or if the oven be too hot, it may be cooled by means of them—those which enter the flue serve to cool the wall of the oven when required.

A thermometer fixed in an earthenware tube and packed in asbestos, passes down through the roof into the oven, and thus enables the temperature to be regularly observed.

An oven of this kind, 14 feet in diameter, costs in Paris £120, and is capable of baking 14 batches of bread formed on the French system in 24 hours. The economy of fuel is considered to be fully 50 per cent. upon the oven in common use, as was satisfactorily established by a series of accurate experiments conducted under the superintendence of a committee of the *Société d'Encouragement*.

Quantity of Gluten contained in Wheat.—When chemical analysis was first applied to ascertain the composition of such substances as seeds of plants, bulbous roots, &c., the examination of one sample was considered sufficient to determine the matter. It is now, however, well known that the composition of any given part of a plant or an animal varies under the influence of a thousand circumstances, such as age, climate, soil, &c. Among the curious facts of this kind recently observed is the total absence of gluten in some wheats. Hitherto the quantity of gluten in wheat was considered to be an index of its nutritive value, but M. Millon* found a species of wheat from Algiers which contained no gluten whatsoever, although the grains were large and the corn very fine and much sought after. The quantity of nitrogen contained in a plant was looked upon as having a very close relation to the quantity of gluten, but M. Millon has found specimens of wheat containing only from 5.7 to 6.3 per cent. of gluten, while the quantity of nitrogen found would be equivalent to 10.3 per cent. of gluten. Whether the whole of this nitrogen existed in a form capable of being assimilated, is a point upon which it is impossible to decide in the present state of science. It is, however, certain that the nutritive values of different substances given in books upon agriculture are of little value. From M. Millon's experiments, it would appear that many samples of wheat come into market which contain very little gluten, and that wheat containing from 6 to 9 per cent., which have hitherto been considered as exceptions, are perhaps very common. Although the flour of wheat poor in gluten is the most difficult to work and does not rise well, it is not unfitted to make bread.

Composition of the Bread supplied to the troops of the different countries in Europe.—Although the preceding remarks detract considerably from the value of comparisons between the nutritive values of wheat or articles made from it, founded upon the determination of the nitrogen which they contain, some of the results obtained by Professor Poggiale† may yet be

* Comptes Rendus, Jan., 1854. No. 1.

† Journal de Chimie Médicale, Sept., 1853, p. 529.

interesting. Some three or four years ago some objection was made to the character of the bread provided for the troops in France, and a commission was accordingly appointed to examine into the question, and to ascertain the quality of that supplied to the troops in other countries. The chemical part of the inquiry was entrusted to Professor Poggiale, who gives the following as his results of the examination of the commissariat bread of the greater number of Continental countries:—

			100 parts of the Bread, dried at 248° Fahr., contained of Nitrogen,		Corresponding quan- tity of Nitrogenous Principles.
Commissariat Bread of	Paris,	...	2.26	...	14.69
"	"	Baden,	...	2.24	14.56
"	"	Piedmont,	...	2.19	14.23
"	"	Belgium,	...	2.08	13.52
"	"	Holland,	...	2.07	13.45
"	"	Württemberg,	...	2.06	13.39
"	"	Austria,	...	1.58	10.27
"	"	Spain,	...	1.57	10.20
"	"	Frankfort on the Maine,	1.44	...	9.36
"	"	Bavaria,	...	1.32	8.73
"	"	Prussia,	...	1.12	7.28

If we calculate what these qualities would represent in the bread in its undried state we would have the result for the highest, that is the French, 9.85 per cent. of glutenous substances, and for the lowest, or Prussian, 4.85 per cent. As the commissariat bread is made of flour produced by grinding the whole wheat or rye without separating the bran, the preceding table is of interest, as showing the extreme variation of quality which wheat and rye may undergo. This fact is of the utmost importance to the working classes, in whose food bread occupies the first place; it would certainly make a great difference to a working man whether he purchases for the same sum of money a loaf containing only from 5 to 6 per cent. of muscle-forming elements, or one containing from 9 to 10 per cent., and yet this is of frequent occurrence. The preceding table does not express absolutely the relative nutritive qualities of the bread, for, independent of the observation already made, that the quantity of nitrogen in a bread may not always indicate the amount of assimilable nitrogenous substances which it may contain, the mode of making the bread has a great deal to do with its quality; in this respect the French bread surpassed all the other breads examined.

It results from M. Poggiale's experiments, that bread made of wholemeal, although containing less nutritive substances than flour of the first quality, is better in this respect than second quality flour. Nevertheless, it cannot be denied, that bread made with wholemeal is generally very brown, does not rise well, has an acid taste, and is difficultly digestible. There is another point of importance in considering the quality of wholemeal bread, namely, that the wholemeal of wheat absorbs more water than white meal flour and consequently yields more bread. This would, however, be a disadvantage to the consumer, although it would benefit the baker.

Nutritive Value of Bran.—To understand properly the relative quality

of wholemeal wheaten bread, we should know the composition of bran, since the difference between white flour and wholemeal is the presence of the bran in the latter. Bran is considered by some persons as a highly nutritive substance, whilst others consider it of no value, and even positively injurious to the bread. The analyses of bran, made by the usual method adopted for the determination of the constituents of similar substances, appeared to strengthen the opinion that it was highly nutritive; for everything which was dissolved by ether, alcohol, water, acids, and alkaline solutions, was considered nutritive, those being the menstrua employed in the preparation of pure cellulose or woody matter, which is undoubtedly not nutritive. In order to arrive at some definite result, M. Poggiale made a series of experiments, both chemical and physiological, upon the nutritive value of bran. He found that 100 parts of the bran formed by the separation by bolting of 15 per cent. of wholemeal, gave the following results:—

Water	...	...	...	...	...	...	12.65
Substances soluble in boiling water	...	...	...	...	...	...	30.82
Substances soluble in dilute hydrochloric acid, consisting of 1 of acid to 20 of water	...	...	...	...	...	...	34.37
Substances soluble in solution of caustic potash containing 10 per cent. of potash	...	...	...	...	...	...	12.74
Insoluble cellulose	...	...	...	...	...	...	9.42
							<hr/> 100.00

By still further washing the cellulose with acids and alkalies, the quantity of cellulose was reduced from 9.42 per cent. to 5.73, and on then employing a concentrated solution of potash it was further reduced to 4.53, but the cellulose appeared to have been attacked. Taking 5.73 therefore as the real quantity of cellulose, and supposing that everything soluble was assimilable, 100 parts of bran would thus appear to contain 81.62 per cent. of solid food. This, however, appears not to be the case, for cellulose from the interior of cells, and that whose organization is not far advanced, will dissolve in acids and alkalies, and is even slightly acted upon by water under the latter circumstances. From other experiments M. Poggiale shows that bran contains in reality 35 per cent. of woody matter; and from the physiological experiments which he made by feeding dogs and fowl with bran, he has arrived at the conclusion that, besides the large proportion of cellulose or woody matter just mentioned, bran contains a considerable amount of matter which cannot be assimilated. The whole proportion of bran which can serve as food he sets down at 44 per cent., and the portion useless as food at 56 per cent.

An apothecary of Bietigheim, in Württemberg, named Sigle, proposes* to employ bran for making bread in a very singular way. He mixes up into a thin dough a given weight of bran with a certain measure of boiling water, and then adds a given weight of dilute sulphuric acid, stirs the mixture for some minutes, and allows it to stand for 24 hours. At the

* Württembergischen Wochenblatt für Land und Forstwissenschaft. No. 6 1854.

expiration of this time it is put into a closely woven basket, and the thick liquor which drains through collected in a vessel underneath. The drained mass in the basket may be either pressed to get out all the liquid, and the residue used as food for pigs, or it may be treated with fresh sulphuric acid and water, and after standing for several days, worked into dough with half its weight of fresh flour. The drained liquid is to be employed instead of water to make bread, which, it is said, is well tasted and very wholesome! The action of the sulphuric acid is to convert the starch and perhaps a certain portion of the cellulose of the bran, into starch-gum and dextrine. The larger the mass of bran treated with acid, the greater will be the quantity of dextrine produced.

Quantity of Bread yielded by a given weight of Flour, and per-centage of Water in Bread.—In Germany the price of bread is fixed by the magistrates, exactly as was formerly the case in many towns in these countries. In striking the assize of bread there, it is of great consequence to know the quantity of bread which a given quantity of flour will produce. The statements to be found in those authors who have written upon this subject vary very considerably, as will be observed by the following figures:—

According to Accum, 100 parts of flour yield	...	125 parts of bread.
" Precht "	"	125 "
" Hermbstädt "	"	133 "
" Dumas "	"	130 "
" Ure (as made in Paris)	...	127 "

In order to arrive at a more accurate result from actual experiment, Dr. Heeren, of Hanover, at the instance of the magistrates of that city, investigated the matter,* and has arrived at the conclusion that 100 parts of wheaten flour, which he estimates to contain, on an average, 12·85 per cent. of moisture, yields from 125 to 126 parts of ordinary bread.

In close connection with these experiments are some interesting ones of Dr. Fehling, of Stuttgart, with respect to the quantity of water in bread.† His experiments were made upon loaves of 6 lbs., 3 lbs., 1½ lbs., and 1 lb. each, and the following are his results:—

A.—6lb. Loaf of White Bread.

The Pith contained	...	49·6 per cent. of water.
" Crust "	...	19·3 " "
" Whole bread	...	47·1 " "

B.—3lb. Loaf of White Bread.

No. 1. The Pith contained	...	48·4 per cent. of water.
" Crust "	...	16·5 " "
" Whole bread	...	44·3 " "
No. 2. " Pith "	...	47·9 " "
" Crust "	...	12·5 " "
" Whole bread	...	42·8 " "

* Mittheilungen des Hannoverschen Gewerbevereins, Heft. 6, 1853, through Polytechnisches Journal, Bd. cxxxi., Heft. 4.

† Württembergischen Wochenblatt für Land und Forstwissenschaft. Nos. 6 & 7. 1854.

No. 3.	The Pith contained	...	48.2	per cent of water.
	" Crust "	...	15.2	" "
	" Whole bread	...	41.8	" "
No. 4	" Pith "	...	49.3	" "
	" Crust "	...	21.0	" "
	" Whole bread	...	46.2	" "
<i>B.—3lb. Loaf of Black Rye Bread.</i>				
No. 1.	The Pith contained	...	50.3	per cent. of water.
	" Crust "	...	18.8	" "
	" Whole bread	...	44.2	" "
No. 2.	" Pith "	...	49.3	" "
	" Crust "	...	9.9	" "
	" Whole bread	...	43.2	" "
No. 3.	" Pith "	...	49.3	" "
	" Crust "	...	17.9	" "
	" Whole bread	...	44.1	" "
<i>C.—1½lb. Loaf of White Bread.</i>				
	The Pith contained	...	48.7	per cent. of water.
	" Crust "	...	16.6	" "
	" Whole bread	...	45.4	" "
<i>D.—1lb. Loaf of White Bread</i>				
	The Pith contained	...	48.2	per cent. of water.
	" Crust "	...	14.7	" "
	" Whole bread	...	43.9	" "

From these experiments we may conclude that the pith of white, fresh, well-baked bread contains about 45 per cent. of water, and black rye bread perhaps 48 per cent. Some samples of bread have been found containing as much as 54 per cent. of water, and we recollect even 55 per cent., that is, 10 per cent. more than ought to have been in it—a difference equal to that usually existing between the price of the best bread and that of inferior quality. An increase of the water contained in bread to the extent of 5 per cent. would make an immense difference to the working classes of a large city; and yet how often do dishonest bakers increase it to such an extent with impunity.

The question of the quality of bread to a community is of paramount importance, but as yet people have not learned to estimate the true value of quality in any article of food, for even all agricultural improvement has reference solely to quantity. It would be interesting to compare the different breads sold in a large city with reference to the amount of water and the amount of azotized or muscle-forming substances which they contain, and their price. In this way the extent of variation in quality might be approximately ascertained. We shall endeavour to present our readers with results of some experiments upon this point in an early number.

Method of improving and rendering sour Rye or Wheaten Bread sweet.

—While speaking of the quality of bread, we must not omit to notice some recent observations of Liebig, which deserve to be generally known, and which we recommend to the consideration of the Poor Law Authorities. It is known that the gluten of the different varieties of corn undergoes a change while in a moist condition; in a fresh state it is soft, elastic, and insoluble in water, but loses these properties by contact with water. Kept for some days under water, it gradually diminishes in volume, until at last it dissolves into a troubled viscous fluid, which will no longer form dough with

starch. The dough-forming property of the flour is, however, in a high degree caused by the power of the gluten to combine with water, and to transform it into that condition in which it exists, for instance, in animal tissues, in meat and coagulated albumen, namely, when the absorbed water does not wet dry substances. The gluten of corn undergoes a change similar to what it suffers in a moist state by the corn being kept in the condition of flour, in consequence of the latter, from its great hygroscopic property, absorbing water from the atmosphere; the dough-forming property of the flour and the quality of the bread baked therefrom gradually diminish. This deterioration can only be avoided by artificial drying and exclusion of air. This change takes place as rapidly, perhaps even more so, in rye flour than in wheaten flour.

About 24 years ago a method came into use among the Belgian bakers, by the employment of which a flour that if used alone would yield a heavy moist bread, could be made to produce a bread equal to that made from the freshest and best flour. This method consisted in the addition of a little sulphate of copper or alum to the flour. The action of both substances in the preparation of bread consists in the fact, that they form, under the action of heat, a chemical compound with the altered gluten become soluble in water, by which the gluten recovers all its lost properties, and becomes again insoluble and capable of combining with water.

The relations between corn-gluten and casein, with which it has so many properties in common, led Liebig to make some experiments, having for their object to substitute for the two substances just named, so injurious to health and to the nutritive value of the bread, some agent of equal action and at the same time harmless in itself. This agent is pure lime water saturated in the cold. If the part of the flour intended to be made into dough be worked up with lime water, and the leaven or yeast, as the case may be, added, and the mass left to itself, the fermentation will set in as if no lime water were used. If at the proper time the remainder of the flour be kneaded up with the fermented dough, the loaves formed and baked in the ordinary way, a fine, solid, elastic, small-celled bread will be obtained, free from sour taste and soft watery external margin, and of excellent flavour, which is preferred to all others by those who have partaken of it for a considerable time. The proportion of flour to lime water is 19 to 5; that is, for every 100 lbs. of flour, 26 to 27 lbs. of lime water are taken. This quantity does not suffice to make dough, and the necessary amount of common water must accordingly be added. As the acid taste of the bread is removed, the quantity of salt must be considerably increased in order to render it palatable. With respect to the lime water, we know that 1 lb. of lime suffices to prepare more than 600 lbs. of lime water; in the bread made according to the method just described, the lime would be nearly equal to what would be contained in an equal weight of the flour of the leguminous seeds.

It may be considered as a physiological truth, arrived at by experience and experiments, that the flour of the different kinds of corn is not possessed of full absolute nutritive properties; and it appears, from all that we know upon the subject, that the cause of the deficiency lies in the

want of the quantity of lime so indispensable in the formation of bone. The seeds of the cereal grasses contain phosphoric acid in sufficient quantity, but they contain much less lime than the leguminous seeds. This circumstance perhaps explains many phenomena of disease observed in children in the country or in prisons, where the food consists principally of bread, and in this particular point of view the employment of lime water deserves some attention from physicians.

The yield of the flour in bread is apparently increased by a greater absorption of water. For every 19 lbs. of flour used without lime water, Liebig states that seldom more than $24\frac{1}{2}$ lbs of bread were obtained in his own house; kneaded with 5 lbs. of lime water, the same quantity of flour yielded 26 lbs. 6 oz. to 26 lbs. 10 oz. of thoroughly well baked bread. As according to Heeren's determinations, already mentioned, the same quantity of flour only yields 25 lbs. 1·6 oz., it appeared to Liebig that the increase of weight in the bread was the result of the employment of lime water.

ART. II.—Catalogue of the several Localities in Ireland where Mines or Metalliferous Indications have hitherto been discovered, arranged in Counties according to their respective Post Towns.

(Continued from page 293.)

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
KERRY.		
Ardfert, ...	Vicinity of, Lead ...	20 & 21
Castleisland, ...	Clogher, Silver, Lead and Copper,—worked by Royal Hibernian Mining Company, ...	30
Castlemaine, ...	Annagh, (East), Argentiferous Lead with Zinc,—discovered in 1789, on the Godfrey Estate ...	47
	*Meanus, Lead and Copper,—Resident Director, John Giles, Esq. ...	47
Causeway, ...	*Ballinglanna, Lead, ...	9
	*Coast West of Cashen River, Lead and Copper,—Mr. Griffith, MSS. ...	9, &c.
	Lixnaw, Vicinity of, Lead ...	15 & 16
Dunquin, ...	*Vicinity of, Copper ...	52
Kenmare, ...	Ardtully, (Cloontoo), Copper, worked by Kenmare and West of Ireland Mining Company ...	93
Lansdowne Mines	{ Caher West, (Shanagarry), Argentiferous Lead, and Copper, Killowen, Lead ...	93
	Public Garden of, Lead,—observed by Rev. Professor Haughton, F.T.C.D. ...	93
	West of, Copper ...	93, &c.
Killarney, ...	Cahernane, Argentiferous Lead,—Report by M. Raspe in 1761, Mr. Griffith, MSS. ...	66
	Muckross, Copper, Cobalt and Sulphur Ore,—Cobalt discovered by M. Raspe in 1794 ...	74
	Ross Island, Copper, and Lead with Zinc,—discontinued from the influx of water from the lake; £80,000 worth of ore raised in four years—R. Griffiths, Jun. ...	66

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
Sneem,	<i>*Behaghane</i> , Copper	106
<i>Carrigcrohane Mines</i>	<i>*Garrough</i> , Copper	106
	<i>*Staigue</i> , Copper,—Mr. Griffith, MSS., Mines of Ireland	99
Tralece, ...	Ballybeggan, Lead and Copper	29
	Ballymullen, Lead and Copper	29
	Lissooleen, Silver, Lead, and Copper	30
	Oak Park, Lead,—Mr. Griffith, MSS.	29

KILDARE.

Celbridge, ...	Ardclough, Lead	15
	<i>Wheatfield Upper (Church Mine)</i> , Lead with Zinc,—Mr. Griffith's Mining Report 1828	15
Edenderry, ...	<i>Freagh</i> , Lead	3
Newbridge, ...	<i>*Punchersgrange</i> , Copper,—Mr. Griffith, MSS.	17

KILKENNY.

Castlecomer, ...	<i>Aghamucky</i> , Clay-ironstone,—Mr. Griffith's Coal Reports 1814	6
	<i>Coal district</i> , Clay-ironstone,—Estate of Hon. Charles H. Butler C. S. Wandesforde	6, &c.
Inistioge, ...	<i>*Ballygallon</i> , (East Bank of Nore), Argentiferous Lead,—communicated by Rev. Jas. Graves	32
Kilmacow, ...	Dunkitt, Lead,—communicated by Samson Carter, Esq., C.E.	43
Knocktopher ...	<i>*Knockadrina</i> , (<i>Flood Hall</i>), Lead and Silver,	27
	<i>*Vicinity of</i> , Copper,	31
Thomastown, ...	<i>*Grenan</i> , Iron, (Micaceous),—Estate of Right Hon. the Earl of Carrick	28

KING'S COUNTY.

Edenderry, ...	<i>Edenderry</i> , (<i>Blundell Mine</i>), Lead	12
Kinnitty, ...	<i>*Slieve Bloom Mountains</i> , Lead and Copper,	36, 37, &c.

LEITRIM.

Drumkeeran, ...	<i>Creevelea District</i> , Clay-ironstone	15, 16, &c.
Lurganboy, ...	<i>*Gortnaskeagh</i> , Copper,—Mr. Griffith, MSS.	11
	<i>*Pollboy</i> , Copper	11
<i>Twigspark Mines</i> , {	<i>Barrackpark</i> , Argentiferous Lead	7
	<i>Twigspark</i> , Argentiferous Lead	7
Mohill, ...	<i>*Gortinee</i> , Iron,	35

LIMERICK.

Askeaton, ...	<i>Ballycanauna</i> , (<i>Ballysteen</i>), Argentiferous Lead and Silver,—Mr. Griffith, MSS.	11
	Ballynagarde, Iron (Hematite)—Ed.	
Doon, ...	Carribeg, (Castletown), Lead,—communicated by Professor Apjohn, T.C.D., and R. Hodgson Smyth, of London, Esq., property of Captain Hore	25
Oola, ...	<i>Oolahills</i> , Copper, Argentiferous Lead, and Sulphur Ore, —worked by Oola Silver Lead and Copper Mining Company	25
Newcastle, ...	<i>Mahoonagh</i> , <i>Vicinity of</i> , Lead	36
Rathkeale, ...	<i>Ballydoole</i> , Argentiferous Lead,—communicated by John L. Worrall, of Limerick, Esq., C.E.	3
Pallaskenry, ...	<i>Cloghatrida</i> , Argentiferous Lead	20

LONGFORD.

Longford, ...	<i>*Vicinity of</i> , Argentiferous Lead,—Mr. Griffith, MSS.	14
Scrubby, ...	<i>*Clcenrah</i> , Iron	3

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
LOUTH.		
Clogher, ...	*Clogher, Copper,—Gossan on Shore, Mr. Griffith, MSS.	22
Drogheda, ...	*Oldbridge, West of, Lead and Copper	23 & 24
Dundalk, ...	*Crumlin, Lead	7
	*Fairhill, Lead,—communicated by E. Wright, Esq., LL.D., and Hon. Capt. Jocelyn	7
Jonesborough, ...	*Vicinity of, Antimony	1
Togher, ...	*Salterstown, Lead and Copper,—Mr. Griffith's Mining Report	16

MAYO.

Ballycastle, ...	*Belderg More, Copper,—communicated by R. W. Townsend, Esq., M.A.	6
	*Geevraun, Copper	5
Ballyhaunis, ...	Ballynastockagh, (Bellaveel), Lead,—Estate of John Birmingham, Esq.	103
Louisburgh, ...	*Vicinity of, Copper and Sulphur Ore,—communicated by Sir Richard O'Donnell, Bart.	86
Newport, ...	*Achill Island, South Western shore of, Mundic,—communicated by Sir R. O'Donnell, Bart.	65
	*Clare Island, Sulphur Ore	85, &c.
Corraun Mines	*Bolinglana, (Clew Bay), Copper, Sulphur Ore, and Argenteriferous Lead	75
	*Srahmore, (Clew Bay), Copper, Sulphur Ore, and Argenteriferous Lead,—Estate of Sir R. O'Donnell	65
Westport, ...	*Tawnycrower, (Sheeffry), Argenteriferous Lead	107

MEATH.

Ardcath, ...	*Cloghan, Lead,—very ancient, Mr. Griffith, MSS.	33
Athboy, ...	South of, Lead	29 & 35
Slane, ...	Dollardstown, Copper and Lead,—Mr. Griffith's Mining Report	26
Beaupark Mines, ...	Painestown, Copper	26
Walterstown, ...	Brownstown, Copper,—worked in the year 1800, by Sir John Dillon, Charles Dillon, and Nat. Preston, Esqrs., Mr. Griffith, MSS.	32
	Cusackstown, Copper	32
	Kentstown, Copper	82

MONAGHAN.

Ballybay, ...	*Corbrack, Lead	19 & 24
	*Cornamucklagh South, Lead	19
	*Dernaglug, Lead	19
	*Derryglush, Lead	14
	*Sra, Lead	24
Bellanode, ...	Derryleadigan Jackson, Lead with Zinc,—Mr. Griffith, MSS.	8
Bellatrain, ...	*Corduff, Manganese	27
Carrickmacross, ...	Knocknacran East, thick beds of Gypsum, worked by Evelyn John Shirley, Esq.	31
Castleblayney, ...	*Carrickagarvan, Argenteriferous Lead and Sulphate of Barytes	25
	*Cornalough, Argenteriferous Lead and Sulphate of Barytes	25
	*Dromore, Lead,—communicated by Joseph Backhouse, Esq.	25

Post Towns.	Localities and Counties.	Reference to No. of Ordinance Sheet.
Portroe, ...	* <i>Garrykennedy</i> , Lead	13
	* <i>Laghtea</i> , Lead	19
Silvermines, ...	* <i>Ballygown South</i> , (<i>Silvermines</i>), Argentiferous Lead,—worked by General Mining Company for Ireland,—Geo. M'Dowell, Esq., F.T.C.D., Sir Jas. Murray, &c., Directors	26
	* <i>Cloonanagh</i> , Sulphur Ore,—Mr. Griffith, MSS. ..	26
	* <i>Cooleen</i> , Lead	26
	* <i>Coolrantha</i> , Copper	32
	* <i>Garryard East</i> , Lead and Copper, both Argentiferous	26
	* <i>Garryard West</i> , Lead and Copper, both Argentiferous	26
	* <i>Gorteenadiha</i> , (<i>Gurtadynes</i>), Lead and Copper, both Argentiferous	26
	* <i>Gortshaneroe</i> , (<i>Ballynoe</i>), Lead and Copper, both Argentiferous	26
	* <i>Knockanroe</i> , Lead with Zinc, Copper and Sulphur Ore	26
	* <i>Shalle Coughlan & White</i> , (<i>East and West</i>), Lead, Silver, and Copper,—Report, H. English, Esq. ...	26
Tipperary, ...	* <i>Aherlow Vale</i> , Argentiferous Lead, Copper and Manganese	74

TYRONE.

Coal Island ...	* <i>Annagher</i> , Clay-ironstone,—Mr. Griffith's Coal Reports,	47
Cookstown, ...	* <i>Unagh</i> , (<i>Slieve Gallion</i>), Iron	29
Gortin, ...	* <i>Crockanboy</i> , Lead	19 & 27
	* <i>Munterlony Mountains</i> , Antimony,—Estate of George Knox, Esq., Mr. Griffith, MSS.	12 & 19
	* <i>Teebane West</i> , Lead	19
Pomeroy, ...	* <i>Crannogue</i> , Copper	45

WATERFORD.

Annestown, ...	* <i>Knockane</i> , Copper	25
	* <i>Woodstown</i> , Copper	25
Bunmahon, ...	* <i>Ballydowane</i> , Copper and Argentiferous Lead,—worked by Mining Company of Ireland	24
	* <i>Ballynagigla</i> , Copper	25
	* <i>Ballynarrid</i> , Copper	24
	* <i>Ballynassissala</i> , Copper	24 & 25
Knockmahon Mines, ...	* <i>Kilduane</i> , Copper and Native Copper	25
	* <i>Kilmurrin</i> , Copper	25
	* <i>Knockmahon</i> , Copper, Argentiferous Lead with Zinc, and Cobalt,—cobalt discovered by J. H. Holdsworth, Esq., see Jour. G. S. D.	25
	* <i>Tankardstown</i> , Copper	25
	* <i>Templeyverick</i> (<i>Tracnastrella and Trawnamoe</i>), Copper	24
	* <i>Seafield</i> , Copper	24
Ballynamult, ...	* <i>Carrigroe</i> , Copper—communicated by R. W. Townsend, Esq., M.E.,	13
	* <i>Knockatrellane</i> , (<i>Ballymacarbray</i>), Copper, Mr. Griffith, MSS.	5
Carrick-on-Suir	* <i>Killerguile</i> , Iron, (<i>Micaceous</i>),	7
	* <i>Monminane</i> , Lead	7
Dungarvan, ...	* <i>Drumslig</i> , (<i>Slieve Grian</i>), Iron,—discovered and worked by Sir Walter Raleigh	35
Stradbally, ...	* <i>Killelton</i> , (<i>Lady's Cove</i>), Copper	32
	* <i>Kilminnin</i> , Copper	24
Tramore, ...	* <i>Ballykinsella</i> , Copper	17
Youghal ...	* <i>Coast opposite</i> , Lead, Mr. Griffith, MSS. ...	40

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
WEXFORD.		
Carrick,	... <i>*Barrystown</i> , Argentiferous Lead with Zinc, and Iron,—worked 65 years ago by Mr. Ogle ...	4
Enniscorthy	... <i>*Aughathlappa</i> , Argentiferous Lead ...	19
	... <i>*Bree</i> , Mundie ...	25
	... <i>*Caim</i> , Argentiferous Lead with Zinc, Copper, Iron, and Sulphur Ore, ...	19
	... <i>*Killoughrum</i> , Lead ...	19
	... <i>*Mangan</i> Lead ...	19
Riverchapel,	... <i>*Courtown Harbour</i> , Iron ...	12
Wexford,	... <i>*Kerloge</i> , Copper,—the ore is Malachite, Mr. Griffith, MSS.	42

WICKLOW.

Annamoe,	{ <i>*Brockagh</i> , (<i>Luganure, Glendasan</i>), Lead, Mr. Griffith's Mining Report ...	17
Glendalough Mines	{ <i>*Lugduff</i> , Lead, Copper, and Iron,—(this group contains Ruplagh, Hero, Hawk Rock, Van Diemen's Lodes, &c.) ...	23
	{ <i>*Seven Churches or Camaderry</i> , (<i>Luganure, Glendasan</i>), Argentiferous Lead, and Copper with Zinc ...	17 & 23
Arklow,	... <i>*Aughrim Lower</i> , Copper ...	34
	... <i>*Ballinagore</i> , Copper ...	39
	... <i>*Ballintemple</i> , Lead ...	40
	... <i>*Ballycoog Upper</i> , Copper and Iron ...	39
	... <i>*Clonwilliam</i> , Lead,—see Report by Warington W. Smith, Esq., M.A., of Geol. Survey ...	40
	... <i>*Coolbawn or Coolballintaggart</i> , Particles of Gold ...	39
	... <i>*Goldmines River</i> , particles of Gold and Tin ...	40
	... <i>*Killacoran</i> , particles of Gold,—communicated by Joseph Backhouse, Esq., ...	39
	... <i>*Knocknamohill</i> , Copper and Iron ...	40
	... <i>*Moneyteige Middle and South</i> , Copper, Iron, and particles of Gold ...	39
Ballinalea,	... <i>*Ashford</i> , Copper ...	25
	... <i>*Ballymacahara</i> , Copper ...	25
Baltinglass,	... <i>*Boleylug</i> , (<i>Moatamoy</i>), Lead,—Mr. Griffith's Mining Report ...	27
Blessington,	... <i>*Cloghleagh</i> , {Manganese and Hematic Iron containing per oxide 84, or metallic iron 59 per cent., Professor Haughton's Analysis } ...	6
	... <i>*Glenasplinkeen</i> { } ...	5
	... <i>*Knockatillane</i> , { } ...	5
	... <i>*Glenasplinkeen</i> { } ...	5
Bray,	... <i>*Bray Head</i> , Copper ...	8
Enniskerry,	... <i>*Douce Mountain</i> , Lead and Copper ...	12, &c.
	... <i>*Powerscourt</i> , Lead and Copper,—Mr. Griffith's Mining Report ...	7, &c.
Hollywood,	... <i>*Glen of</i> , Lead,—See Report by Richard Griffith, Esq., LL.D. ...	9
Kiltegan,	... <i>*Aghavannagh Mountain</i> , Lead and Copper ...	28
Rathdrum,	... <i>*Ballinacarrig Lower</i> , Copper ...	35
	... <i>*Ballinaclash</i> , Lead ...	35
	... <i>*Ballinagappoge</i> , particles of Gold and Tin ...	34
	... <i>*Ballygreen</i> , particles of Gold,—See on Geology of East of Ireland, by Mr. Weaver ...	34
	... <i>*Ballygahan Lower and Upper</i> , (<i>Ovoca</i>), Copper and Sulphur Ore,—worked by Henry Hodgson, Esq., ...	35
	... <i>*Ballymoneen</i> , Copper, Iron and Sulphur Ore,—Mr. Griffith, MSS. ...	35
Ballymurtagh Mines,	{ <i>*Ballymurtagh</i> , (<i>Ovoca</i>), Copper with Zinc, Sulphur Ore, Iron and Auriferous Gossan—Apjohn ...	35
	{ <i>*Kilcashel</i> , Copper and Sulphur Ore,—worked by Wicklow Copper Mine Company ...	35

Post Towns.	Localities and Counties.	Reference to No. of Ordnance Sheet.
	* <i>Castlehoward</i> , Copper and Sulphur Ore ...	35
	* <i>Connary Upper</i> , Copper, Lead with Zinc, Sulphur Ore, Antimony, Arsenic & Auriferous Silver, ...	35
	* <i>Cronebane</i> , (<i>Ovoca</i>), Copper with Zinc, Sulphur Ore, Auriferous Silver, and Lead ...	35
	* <i>Ballinafunshoge</i> , Lead with Zinc,—Mr. Griffith's Mining Report ...	23
	* <i>Ballinagoneen</i> , Lead with Zinc, and Copper,—worked by Sir C. P. Roney, &c. ...	22 & 23
Glenmalur Mines.	* <i>Ballyboy</i> , Lead ...	23
	* <i>Baravore</i> , Lead with Zinc, and Copper ...	22
	* <i>Camenabologue</i> , Lead and Copper ...	23
	* <i>Clonkeen</i> , Lead with Zinc, and Iron ...	23
	* <i>Conavalla</i> , Lead ...	22
	* <i>Corrasillagh</i> , Lead with Zinc ...	23
	* <i>Cullentraigh Park</i> , Lead ...	23
	* <i>Killeagh</i> , (<i>Ovoca</i>), Copper and Sulphur Ore ...	35
	* <i>Kilmacoo and Upper</i> , (<i>Ovoca</i>), Copper ...	35
	* <i>Knockanode</i> , (<i>Ovoca</i>), Lead and Sulphur Ore,—worked by Captain Liffan, M.P., property of George C. Mahon, Esq.,—see Weaver's Geology of E. of Ireland, Trans. Geol. Soc. Lond. ...	35
	* <i>Templelusk</i> , Sulphur Ore,—communicated by Joseph Backhouse, Esq. ...	35
	* <i>Tigronney East and West</i> , (<i>Ovoca</i>), Copper and Sulphur Ore,—worked by Messrs. Williams ...	35
	* <i>Vicinity of</i> , Copper ...	30
Redcross,	... * <i>Templelyon</i> , Iron, Copper and Sulphur Ore,—property of Wentworth Ereck, Esq. ...	36
Roundwood,	... * <i>Lough Dan</i> , Lead with Zinc, and Copper ...	17
	... * <i>Lough Tay</i> , Lead ...	12
Shillelagh,	... * <i>Vicinity of</i> , Lead,—Report by Richard Griffith, Esq., LL.D., Inspector General of Her Majesty's Royal Mines in Ireland, Chairman of the Board of Public Works, &c. ...	43
Tinahely,	... * <i>Carrigroe</i> , Lead ...	38

ART. III.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

Application of the Electric Light to Metallurgic purposes.—M. Pichon proposes to smelt the ores of iron and other metals by means of the same arrangement as that employed to produce the electric light, and in this way do away with the necessity of employing the immense quantities of fuel which is now used for that purpose. His apparatus consists of a series of electro magnets with revolving armatures, set in motion by a steam engine, exactly on the plan employed by Messrs. Elkington and Mason to develop electric currents for plating and gilding. The poles of the battery thus formed consist of carbon prisms 3 metres long, (9 feet 10 inches,) with square bases, each side being 60 centimetres (about 2 feet), one end being cut in the form of a cone, 50 centimetres (nearly 1 foot 8 inches) long. The square end of this prism is set in a metallic armature furnished with a ring, to which the conductors are attached, and is held between the jaws of a kind of

vice moving in a slide, by which the charcoal can be advanced as fast as it consumes. Each two of these charcoal prisms with its battery constitutes what M. Pichon calls a *system*. A number of these systems may be arranged one over the other, so as to produce a great zone of heat. Over the charcoal prisms is fixed a hopper from which the ore and flux fall through the arch of electric light where the reduction and fusion of the metal takes place; an inclined plane conducts the ore and flux into the hopper. Under the charcoal is placed a crucible like that of a high furnace, into which the slag and fused metal fall after the ore has been reduced, and where they arrange themselves according to their specific gravities, and from the bottom of which the metal may be tapped in the usual way. Where necessary a hearth may be put in connexion with the crucible, so as to maintain the temperature.

Another arrangement is to place the prisms in an inclined position, and make them hollow throughout their length, the hollow being made cylindrical, so as to form a tube 40 centimetres in diameter. The ore and flux are introduced into this tube, and pushed forward by a kind of piston, so as to issue at the point of the charcoal in the midst of the electric arch. When six or nine systems are employed it is only necessary to have the two or three upper ones hollow. A constant stream of ore and flux can in this way be made to fall through the heated zone, for while the piston of one prism is driving forward a charge of ore through the tube, the opposite tube of the same system may be recharging.

Application of Gas to Assay Furnaces.—MM. Peligot and Levol have established in the Paris Mint furnaces for assaying gold, in which common coal gas is employed as the source of heat with considerable advantage.

New kind of Peat Charcoal.—M. Busson du Maurier, *apropos* of the prize of 3,000 francs offered by the Société d'Encouragement of Paris, for the best process by which a fuel adapted for household and manufacturing purposes may be economically prepared from peat, has written to that society to the effect that he has succeeded in preparing an excellent solid, compact, and tenacious charcoal, or rather coke, by distilling peat mixed with small bituminous coal. This coke, he says, is admirably adapted for the forging of steel and other metallurgical operations.

MANUFACTURES FROM MINERAL SUBSTANCES.

New process for the Manufacture of Glass for Optical Purposes.—In the present state of this manufacture the mass of glass having been brought to a state of fusion in the crucible or pot, it is simply stirred to render the material homogeneous, and to free it from the air which it contains. This double result is, however, very rarely attained, and the operation of stirring, such as it is, performed, gives rise to the formation of numerous striae, which renders the larger part of the glass unfit for the making of lenses. Hence arises the difficulty of obtaining object glasses of large dimensions. M. de Peyronny believes to have found the solution of this difficulty, that is, the means of manufacturing glass free from defects, by communicating to the pot which contains the material in fusion a rather rapid rotary motion about a central vertical axis; the centrifugal force would have the effect, according to him, of collecting all the air bubbles towards the centre of the vitreous mass, while the striae produced by the stirring would in great part disappear, and those which would remain would be circular and but slightly injurious, if care be taken to make the axis of the primitive mass the axis of the lens.—*Comptes Rendus de l'Académie*, 15 Mai, 1854.

Novel mode of constructing Ships.—M. Lomb-Miraval has called the attention of the Société d'Encouragement to a method of constructing ships perfectly novel. According to this system vessels are made altogether of iron wire and hydraulic cement, and the inventor attributes to them the following advantages:—Great solidity, absolute impermeability, facility of repair in case of shipwreck, perfect stability, by the ballast being fixed to the bottom and forming a part of the frame, and finally, incomparable rapidity of construction. A barque, constructed six years ago upon this system, has been since navigated without requiring any repairs, although it has undergone some rough tests. Nothing would be easier, says M. Miraval, than to construct, in a few days, on board the vessels of an

expeditionary fleet, as many gun-boats or debarkation rafts as may be desirable.—*Cosmos*, No. 10, vol. 5.

New Plastic Material.—Dr. Emil Braun, of Rome, has, it is said, discovered a new plastic material, capable of being moulded with all the sharpness of contour of plaster of Paris; having the whiteness and the character of the finest statuary marble; having a more impermeable surface than that material, and uninfluenced by humidity, and consequently capable of withstanding all the inclemencies of the seasons. The inventor has already produced several busts and statues, which the most competent artists of Rome have greatly admired. They have all recognised the beauty and the incomparable value of this material, whose fracture has a marble-like crystalline appearance, and which nevertheless may be moulded into the smallest and most delicate forms, and into the most colossal, for it is not crushed by its own weight, however large that may be. The price of objects of art made with this material scarcely exceeds in price those moulded in plaster.—*Builder*.

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

Velocimeter for Measuring the Steerage Way of Ships.—MM. Overdeign & Droisnet have devised an instrument under this name for determining the rate of sailing of ships, and which may also be applied to measure the velocity of currents of water and air generally. The principle of its action reposes upon the construction of the liquid vein, whose effect was pointed out a century ago by Daniel Bernoulli, and was since applied by Venturi, by means of the double conical tube which bears his name. It is the negative pressure, or rather the aspiration to which it gives rise in the contracted section, at the intersection of the convergent or divergent cones of which Venturi's tube is formed, which M. Overdeign, Professor at the Royal Academy of Delft, has attempted to utilize in making his velocimeter. A tube made according to the proportions of Venturi's tube is attached to the vessel, parallel to its axis, the base of the small cone being turned towards the bow of the vessel; a hole some *millimètres* in diameter is bored in the tube at the intersection of the two cones, and to this hole a small pipe is adapted. As soon as the vessel is in motion the negative pressure manifests itself and increases with the velocity. To measure the latter, therefore, we have only to note the negative pressures as they augment or diminish with the varying speed of the vessel. This is effected by connecting the small pipe communicating with the submerged Venturi tube to a manometric box similar to that used by M. Vidi in the construction of his aneroid barometers. When the aspiration is produced in the tube the two ends of the manometric box in connection with it approach or diverge according to the extent of vacuum produced, and this vertical movement of the upper and lower sides of the box, transferred by means of a lever into a horizontal movement, gives motion to a needle, which indicates on a dial the number representing the velocity of the vessel. [It would be very easy to make this apparatus self-registering, by causing a pencil point, in connexion with clock-work for registering the time, and attached to the dial needle above mentioned, to trace a curve upon a sheet of paper. In this way the total number of miles traversed by a vessel may, perhaps, be accurately determined.] This velocimeter is exceedingly ingenious, and, from the nature of the principle upon which it is founded, is deserving of the serious consideration of nautical men.

A somewhat analogous, but much less perfect, and in many respects defective and erroneous, instrument, has been recently patented in America, by a Mr. John De Graw, of New York. This instrument consists in placing a tube extending below the surface of the water on the outside of the vessel. The lower end of the tube is furnished with a piston, beneath which is an aperture having a flaring mouth-piece at right angles to the tube. The water reaches through the mouth-piece, which is turned in the direction opposite to that of the current produced by the motion of the ship, and lifts the piston to a height proportionate to the speed of the vessel. The piston is connected with an index located in some convenient position, by which the apparent velocity of the vessel is at all times exhibited to the eye in miles. An opening is made in the tube

both above and below the piston through which the fluid enters; so that whether the density of the water at the base of the tube is increased or diminished, the pressure on the piston is equalized; the only operating force being that derived from the entrance of the water through the flaring mouth-piece. This provision becomes necessary in estuary navigation, where there is often a considerable variation in the density of the water.

Attaching Car Wheels to Axles.—T. G. Walker, of West Farms, New York, proposes to secure wheels to their axles so as to allow of the former being adjusted upon the latter in such a way that they may be moved to suit the broad or narrow gauges of railroads without moving the axles from their boxes. This is effected by having a screw thread cut on each end of the axle—a right hand thread on one end and a left hand thread on the opposite end of the axle. The centre of the wheels have circular apertures through them, with reversed threads of screws to those on the ends of the axles. The wheels are secured at the required distances apart, by means of screw keys, which fit in slots in the axle. By unscrewing the keys the wheels can readily be adjusted to suit different widths of track, such as where a narrow track locks with a broad gauge and the reverse.—*Scientific American*, June 3rd.

Spark Arrestors.—G. B. Simonds and Abel Breuer, of Sangatuck, Connecticut, have made an improvement in spark arrestors, which consists in arranging an elliptical conical deflector in the upper part of the case, and combining it in such a manner with a flange extending around down the draft opening, by which the exhaust is made to act upon the sparks in such a manner as to force them into a side chamber. The capacity of the spark chamber is also increased, and likewise the deflecting surface, at the same time lessening the resistance of the smoke stack by making it of an elliptical form, which thus displaces less air in passing through the atmosphere with its least diameter of displacement, thereby tending greatly to remove the evil of a trail of smoke following in the wake of the stack before the eyes of the engineer. The flange around the draft opening is made adjustable for the purpose of regulating the escape of the sparks, so as not to have an escape while passing through a city, village, or any place where there is any danger of setting anything on fire.—*Scientific American*, April 29th, 1854. [The different forms of spark arrestors used in America are worthy the attention of those interested in railways in which turf is being used as fuel for locomotives.]

Improvement in Milling.—G. Mann, Jun., of Ottawa, Illinois, has patented a mode of ventilating and removing moisture from meal as it comes from the stones, before it enters the bolting cloths. All grain contains a certain amount of moisture; this is partially set free by the heat generated by friction in grinding; still it enters into the meal and clogs the bolt cloths, preventing free bolting. This evil increases in proportion to the amount of work to be done, so that more of the meal is carried off with the bran in proportion to the increase of work in the mill, thus lessening the product of fine flour as the speed of the stones is increased. Mr. Mann proposes to carry off the moisture from the meal after it leaves the stones by passing it through a many-sided tapered agitator, and subjecting it, in its passage to the bolts, to a current of cold air. The meal thus treated bolts more freely and allows of a great deal more work being performed in a given time by any mill.—*Scientific American*, May 6th, 1854.

Hansen's Electro-Magnetic Engraving Machine.—This machine is somewhat on the principle of the well-known planing machine. The drawing to be copied and the plate to be engraved are placed side by side on the moveable table or lid of the machine; a pointer or feeler is so connected by means of a horizontal bar with a graver, that when the bar is moved the drawing to be copied passes under the feeler, and the plate to be engraved passes in a corresponding manner under the graver. It is obvious that in this condition of things a continuous line would be cut on the plate, and a lateral motion being given to the lid, a series of such lines would be cut parallel to and touching each other, the feeler, of course, passing in a corresponding manner over the drawing. If then a means could be devised for causing the graver to act only when the point of the feeler passed over

a portion of the drawing, it is clear we should get a plate engraved line for line with the object to be copied. This is accomplished by placing the graver under the control of two electro-magnets acting alternately, the one to draw the graver from the plate, the other to press it down on it. The coil enveloping one of these magnets is in connexion with the feeler, which is made of metal. The drawing is made on a metallic or conducting surface with a rosined ink or some other non-conducting substance. An electric current is then established, so that when the feeler rests on the metallic surface it passes through the coils of the magnet and causes it to lift the graver from the plate to be engraved. As soon as the feeler reaches the drawing and passes over the non-conducting ink, the current of electricity is broken, and the magnet ceases to act, and by a self-acting mechanical arrangement the current is at the same time directed through the coils of the second magnet, which then acts powerfully, and presses the graver down. This operation being repeated until the feeler has passed in parallel lines over the whole of the drawing, a plate is obtained engraved to a uniform depth, with a fac-simile of the drawing. From this a type metal cast is taken, which, being a reverse in all respects of the engraved plate, is at once fitted for use as a block for surface printing.—*Journal of the Society of Arts*; and *Athenæum*, June 17th 1854, through *Philosophical Magazine Supplement*, July, 1854.

Constant Action Blow-pipe.—S. de Luca has proposed to attach a vulcanized India-rubber bag to the tubular stem of a common blowpipe, and to fasten the cylindrical end with its nozzle to the other end of the bag, the latter thus constituting a part of the stem of the blowpipe. The end of the tubular stem which opens into the bag is closed by a valve which opens inwards. If air be blown through such a blowpipe, the elastic bag will be inflated, and as the compressed air cannot return through the valve, it will flow through the nozzle and maintain the blast of air constant, the bag requiring only to be filled from time to time. Such an instrument does away with the inconvenience of maintaining a constant blast by the mouth, which is very tiresome, and to many persons injurious, especially when it is necessary to blow for a considerable time. This form recommends itself as much to jewellers as to chemists.—*L'Institut*, 1854, No. 1054.

IMPROVEMENTS IN THE MANUFACTURE OF TEXTILE FABRICS.

New stuff adapted for Upholstering purposes, Table Covers, Carpets, &c.—M. P. Ducancel, dyer and printer of Amiens, employs the articles made of different materials known by the generic name of Utrecht velvets, such as Thibet satin, and in general all those fabrics in which the pile or surface is in goats' wool, to produce an ornamental cloth adapted for a great many purposes. He applies to the velvet surface, by means of a machine or by blocks, a mordant or size, so as to indicate any desired pattern, and upon this he dusts some fine flocks, exactly as is done in preparing ordinary flock room-papers. The variety of patterns as to forms and colours which may be formed in this way is endless, and some of them are of great elegance and beauty. Stamped velvets, consisting of a pattern stamped with a heated iron, have been already in use, but the effect was not very good, as there was no variety of colours, the patterns being produced by a deadened surface upon a brilliant ground, whilst by the method of Ducancel a fine rich uniform surface is produced, with an endless variety of colours. This material would be well adapted for hangings.

New material for the Cards of Jacquard Looms.—M. Dubois, of St. Denis, near Paris, makes his cards for Jacquard weaving of thin slips of seasoned wood. A committee of manufacturers of the Chamber of Commerce of Lyons have made a very favourable report grounded upon the following considerations: 1. These cards undergo no appreciable dilatation either from moisture, heat, or from use. The designs upon which the commission made their experiments did not undergo the slightest alteration. This result is very important not only for the workman, but above all, in the general point of view, of perfection and accuracy of design, which, as we all know, very often suffers from the extreme dilatibility inherent to the material employed to make the ordinary cards. 2. The cards made of thin leaves of wood are lighter, less cumbersome, more

easily transported, and much less subject to deterioration. 3, They resist better in working, and appear to be capable of lasting longer. 4, and finally, M. Dubois states that he can send them into commerce at a lower price than the worst quality of ordinary pasteboard. The chief advantage is, however, the absence of dilatibility. M. Dubois has also had the happy idea of employing the clippings or residues of his manufacture to make small hollow cylinders, closed at the ends, to wind ribbons upon, in lieu of the solid ones now used.—*Cosmos*, 5th vol., No. 6, p. 147.

IMPROVEMENTS AND INVENTIONS CONNECTED WITH CHEMICAL PROCESSES.

Photographic Experiments of MM. Chevreul and Niepce de St. Victor.—M. Chevreul presented some considerations upon the action of light upon colour so early as the year 1832, long therefore before the art of photography was known. The experiments then made were very curious, and are likely to form the starting point to some important discoveries relative to the nature of photographic action. It is commonly said, and believed, that light fades or destroys colours; this assertion is at once true and erroneous—true in the sense that light contributes in part to the alteration, not of all, but of certain colours, which are considered as very fixed, such, for example, as indigo colours. It is erroneous in the sense that the fading is not the result of the action of the light alone, for M. Chevreul showed that the same colours which are discharged by the sunlight when exposed to the air, are not altered if exposed to the sun's rays in a vacuum, or in atmospheres of nitrogen, hydrogen, &c. Hence he concluded that the alteration was the result of a true oxidation produced under the influence of the sunlight. By placing pieces of uniformly coloured cloth in an atmosphere of oxygen, and covering them with pieces of paper or other material, out of which designs had been cut so as to allow the light to fall on the coloured cloth in one part and intercept it in others, he had obtained true photogenic designs upon the cloth. M. Niepce de St. Victor imagined that the change which the varnish of bitumen of Judea upon metallic plates (with which his uncle Nicéphore Niepce made the first heliographic pictures) undergoes in the sunlight, so as to render it insoluble in oil of lavender or benzine, might be produced in the same way, determined to try whether the same effect would be produced in a vacuum. With this view he prepared two plates of silvered copper, which he covered with a varnish composed of 90 parts of benzine 10 of oil of lemons, and 2 of bitumen of Judea, and allowed them to dry in the dark during 5 months, and then placed upon each of them a photograph upon albumenized glass. One of these plates was then placed in the receiver of a pneumatic machine, and a vacuum made in it; the other was placed in a similar receiver alongside the air-pump. Before making the vacuum, both receivers were covered with a piece of black cloth. A window was opened, and the sunlight allowed to fall during 10 minutes upon the two bells; the shutters were then closed, the photographs upon glass removed, and the plates washed with a solvent composed of 3 parts of petroleum and 1 of benzine. The image appeared upon the plate which remained in the bell full of air, but did not upon that exposed in vacuo. Another experiment was made, in which the plate exposed in vacuo in the first experiment, was exposed in air, and with the same results. It remains now to discover how the air acts. Is the oxygen simply absorbed by the varnish, without any of the elements of the latter being separated; or is there such a reaction among them as to give rise to the production of water and carbonic acid? Whatever be the nature of the action, it is certain the contact of air is necessary to produce the image of Nicéphore Niepce on a plate of metal coated with bitumen of Judea. M. Niepce de St. Victor purposes to repeat his experiments in different gases, and especially in oxygen. M. Regnault observed, in support of the influence of air in the development of photographic images, that in taking positives by means of negatives on paper, that the action is more rigid and more perfect at those points where bubbles of air happen to remain interposed between the two papers. The production of positives may perhaps be accelerated by contriving the access of oxygen, or certain oxygenating substance—binoxide of hydrogen, for example—between the two papers. Experiments made in this direction would be very interesting (*Cosmos*, No. 9, vol. 5).—*Comptes Rendus de l'Académie*, 28th August.

Cement for enamelled Watch Dials.—A cement comes into commerce from Vienna, for repairing the dial-plates of watches when parts of the enamel chips off. It is rather brittle, and is distinguished by its fine white colour, and ready fusibility. From an analysis of Carl Knares, of Stuttgart, it consists of resins, very colourless and very soluble in alcohol, with oxide of zinc. In the specimen examined there was 30 per cent. of zinc white. Attempts to prepare a similar substance led to the following method:—Equal parts of dammara resin and copal, in pieces as colourless as possible, were reduced to a fine powder; to five parts of this mixture two parts of venetian turpentine were added, and the whole rubbed with as much spirit of wine as was sufficient to make it into a thick paste; three parts of the finest zinc white were then rubbed up with it. The mixture had now the consistence of a ground oil paint; on warming it, until the whole of the alcohol was driven off, the mass was melted; and on cooling, had exactly the appearance and properties of the original sample of cement. The latter had, however, a slight tinge of blue, whilst in that made in imitation there was a slight tinge of yellow. This was corrected by the addition of a little Prussian blue to the alcohol used in rubbing up the paste, and a perfectly similar product obtained. The same results were obtained by melting the resins together, and adding the zinc white to the mixture in a melted state. The fusion of the resins must be conducted with the greatest care, in order not to colour it. In this case also a slight addition of Prussian blue to the mass is of advantage.—*Württembergisches Gewerbeblatt*, 1854, No. 35, through *Polytechnisches Journal*, cxxxiii. Heft. 4.

A new Embalming Material.—A Doctor Falconi is said to have discovered a mixture, in the form of a powder, chiefly composed of sulphate of zinc, by which human bodies can be indefinitely preserved. In the case of exhumations for legal purposes, the body may be carried to a convenient place, and kept for the required time, by filling up the coffin with the powder. Bodies may also be transported to a great distance for interment in the same way; this use of it is indeed authorised and recommended by the French police. He has also discovered a liquid for preserving anatomical "subjects" and preparations, the base of which is also sulphate of zinc. This liquid is said to be of remarkable efficacy for this purpose, and is now being used in all the schools of medicine of Paris. Another application of this liquid is for the very absurd process of embalming human bodies—a use, however, which is not likely to be of much importance.—*Cosmos*, vol. 5, No. 6, p. 190.

Composition of Gunpowder.—The following are the results of some apparently very carefully conducted analyses of different samples of gunpowder, made by C. Waltzien:—

	Artillery Powder.				Sporting Powder.	
	Baden.	Prussian.	B. varian.	French.	German.	English.
Saltpetre	72.94	73.58	72.50	73.74	76.35	79.36
Sulphur	12.01	12.45	12.62	13.60	11.52	10.63
Water	2.25	1.89	1.62	2.88	3.60	0.90
Char- { Carbon	10.65	10.12	11.73	10.29	9.58	8.76
coal { Hydrogen	0.49	0.83	0.73	0.58	0.48	0.60
{ Nitrogen & Ash	1.66	1.53	1.85	..	..	..
	100.00	100.00	100.00	101.09	102.13	100.25

The chief feature in these analyses is, that the charcoal has been determined directly as well as the saltpetre and sulphur, and not, as in all previous analyses, calculated as loss. The excess apparent in some of the analyses arises from the estimation of the water being too high.—*Liebig's Annalen*, May, 1854, p. 129.

Soluble Prussiate of Potash.—Some specimens of a soluble prussiate of potash were exhibited at the London Exhibition, which it appears were made by treating a concentrated solution of yellow prussiate of potash by iodide of iron containing an excess of iodine. The blue precipitate formed is collected, washed, and dried; it is perfectly soluble in water. The mother liquor is colourless, and contains

iodide of potassium. The solubility of this blue in water renders it well adapted for the manufacture of ink. When the iodide of iron does not contain an excess of iodine, the resulting precipitate is white; nevertheless it rapidly becomes blue in the air, and then becomes soluble in water.

Bleaching of Gum and Starch.—Mr. Hall bleaches starch by means of chlorine or sulphurous acid; he performs this operation either by passing the gas into the starch suspended in water, or making starch and water fall through a strainer into an atmosphere of chlorine or sulphurous acid. When the bleaching is completed, the starch is treated with water rendered very slightly acid by sulphuric acid, after which it is washed in water and dried. The same process is employed for bleaching gum-arabic and gum senegal previously dissolved in water. When bleached the liquid is deprived of its acidity by some carbonate of soda, and is then evaporated and dried in rarified air.

Supposed poisonous character of some specimens of the Chloroform of commerce, and of the artificial Essences used by Cooks and Confectioners.—MM. Soubeiran and Mialhe have observed that commercial chloroform contains an oily substance, having an ethereal odour. Mr. Pemberton has also observed this fact, and has shown that the oily substance consists of two bodies, which resemble in smell the acetate and valerianate of amyl. One of these liquids is limpid and colourless, and has a density of 0.840, and boils at 138° centigrade; the other is less fluid and less ethereal, and decomposes at its temperature of ebullition. Both of these substances, treated with a mixture of bichromate of potash and sulphuric acid, are transformed into valerianate of amyl and valerianic acid, which shows that they are derived from the *fusel oil*, or amylie alcohol, originally contained in the spirits employed in the preparation of the chloroform. G. Polli, the editor of the *Annali di Chimica applicata alla Medicina*, in alluding to this investigation, remarks that some of the cases of death which have occurred in consequence of the use of chloroform may perhaps be attributed to the presence of amylie alcohol in the chloroform. This remark seems in accordance with some recent experiments of M. Brown-Séquart, who has succeeded in showing that amylie alcohol, which is extremely deleterious when its vapour is breathed, does not produce any apparent alteration if it be injected, without being inspired as vapour.

Considerable alarm appears to have been recently created in various quarters respecting the poisonous characters of most of the compound ethers. It is well known that many of the essential oils used in confectionery and in making liqueurs have been recently replaced by a series of artificial compounds. For example, oil of bitter almonds has been replaced by nitrobenzoid, produced by the action of nitric acid upon benzine, a substance abundantly obtained from coal tar; this body is now sold under the name of *essence de mirbane*, and has almost entirely superseded the real oil of bitter almonds. Butyric ether is used to flavour whiskey, in consequence of its delicate pine-apple odour. This substance is a compound of butyric acid, one of the acids of butter, with common ether. Valerianic acid, is a peculiar acid found in the *valeriana officinalis*, and also found under many circumstances, such as the putrefaction of animal substances, as, for example, old cheese, the peculiar odour of which is owing to the production of this acid. When valerianic acid combines with the peculiar oily substance known as *fusel oil*, or oil of whiskey, to the presence of which whiskey owes its flavour, it forms a peculiar ether, called in chemical language valerianate of oxide of amyl. This compound has a delicious odour, like apples. Several other analogous compounds are also obtained, all of which have agreeable smells; one, for example, resembles the vanilla, another the jargonelle pear, another orange flowers, &c., and many are used to produce imitations of brandy and other liqueurs.

These artificial essences have found great favour with cooks and confectioners, in consequence of their striking imitation of the odours of the most delicate fruits; and accordingly iced creams, blanc-mange, custards, &c., are now very generally flavoured with them. When properly made, and used in proper quantities, they are perfectly harmless, as is fully evident by the millions of creams made with them in Paris. In the last number of the Dublin Hospital Gazette (No. 18), is an extract from the American Journal of Medical Science on this subject, containing some strange chemical facts, which we are sure will be quite new to all

chemists. The extract is from a paper by Dr. A. A. Hayes, read before the Boston Society for Medical Improvement, and states that several persons got ill from eating iced creams flavoured with butyric ether. Another member of the society, Dr. Warren, stated that he had been called to a family in which seven persons had been more or less poisoned by custards flavoured by "extract of vanilla." And Dr. Townsend, on the same occasion, referred to cases of illness caused apparently by acidulated drops, termed banana drops, and added that he believed that one death at least had been produced by them.

That ill-prepared essences might be poisonous, we have no more doubt than we have that quite as much illness is produced by the medicines usually sold in our apothecaries' shops, as there are cures effected by genuine medicines; but we would certainly require somewhat better evidence that pure artificial ethers, employed in small quantities to flavour custards or creams, are poisonous, than the crude American statement referred to. Fully one-half of the whiskey sold in Dublin is flavoured with butyric ether, very crudely made, and we have not heard that many have been poisoned on that account.

New Process of Tanning.—Roswell Enos, of Binghampton, New York, has obtained a patent for a new process of tanning sole leather, which is thus specified: The hair is first removed from the hides in any usual manner, and the hides thoroughly cleaned in either pure water or in a solution of salt and water. A batch of fifty hides are then placed in a liquor composed by steeping 40 lbs. of Sicilian sumach, or 150 lbs. of unground native sumach, in 250 gallons of water, and adding to it 25 lbs. of salt. The hides are to remain in this liquor from 12 to 24 hours, the length of time depending upon the temperature of the liquid and the condition of the hides; the best temperature for the liquid is perhaps, about blood heat. After the hides have remained during the time indicated in the saline infusion of sumach, the liquor is strengthened by the addition of about 200 gallons of strong oak or hemlock liquor and 15 lbs. of salt, and the hides allowed to remain in this strengthened liquor for the space of from 12 to 24 hours. The hides should then be withdrawn and placed in about the same quantity of a strong cold oak or hemlock liquor containing twenty pounds of salt in solution, and allowed to remain in it for five or six days. They are then withdrawn and placed in the same quantity of liquor, but this time at a temperature of blood heat, where they are to remain for from five to six days. This operation is to be repeated six or seven times, when the hide will generally be found to be completely tanned. While passing through each stage of this tanning process the hides should be repeatedly "handled," as is usually done in other processes. This method is peculiar, and certainly, if successful, has the great advantage that no acid or alkali is used; the tannic acid being made to enter the tissue under the influence of the increased endosmotic action induced by the salt. A dried Buenos Ayres hide can, it is said, be tanned by this process in ninety days; an Oronoco hide requires less time; a green or market hide in thirty days; harness or upper leather in the rough twenty days; and calf skins in from six to twelve days. The statements in the account which we have seen of the process in the *Scientific American*, September 16th, relative to the gain of the hides in being converted into leather by this process are evidently erroneous, for example, a Buenos Ayres hide is said to gain 75 per cent. With regard to the quality of the leather made by this process we may add that it is said to be tough and strong, and that a Buenos Ayres hide will make as good sewed work as a well-tanned market hide.

Analysis of a Shaving Soap.—M. Faist has published the following analysis of a shaving soap of Italian origin, which enjoys a well merited reputation:—

Fatty acids	...	...	...	...	57.14
Potash in combination with the fats	...	...	...	...	10.39
Sulphate of potash, chloride of potassium	...	...	...	...	4.22
Carbonate of potash	...	...	...	...	trace.
Silica	...	...	...	...	0.46
Water	...	...	...	...	27.68

The fat acids possessed the characters of mutton suet. This soap differed from

ordinary soaps in its base, consisting exclusively of potash, in being proportionately richer in alkali, the equivalent of potash being higher than that of soda, and finally, in being perfectly neuter, whilst the soaps prepared with an alkaline ley are generally alkaline. This analysis shews that the soap was prepared with commercial potash; but as carbonate of potash does not saponify suet, and only acts upon fat acids, the latter must have been first made from the fat, which may be done by saponifying the fat with about 12 per cent. of slacked lime. The lime soap thus formed may then be decomposed by means of sulphuric or hydrochloric acids, and the fat acids washed from the lime salt, and perfectly saponified with about 30 per cent. of commercial potash at 90°.—*Verhandl. des Nieder-Oest. Gewerbe-Vereins.*

Bleaching Lac.—Dr. Hare, of America, has published the following method for bleaching lac:—Dissolve in an iron kettle 1 part of pearl-ash in about 8 parts of water, add 1 part of shell or seed-lac, and heat the whole to ebullition, when the lac is dissolved, cool the solution and impregnate it with chloric gas, until the lac is all precipitated. The precipitate is white, but the colour deepens by washing and consolidation; dissolved in alcohol, lac bleached by this process yields a varnish which is as free from colour as any copal varnish. Chloride of lime may be substituted for chlorine, chlorine being set free, and the lime being dissolved out of the precipitate by means of some muriatic acid.—*Journal of the Smithsonian Institution.*

Manufacture of coloured Sealing Wax.—Professor Erdman found on analysing some French coloured sealing waxes of remarkable beauty, among which the pure white and the rose red coloured ones were especially fine, that the colouring material consisted chiefly of basic nitrate of bismuth, (bismuth, pearl or Spanish white,) the rose-red being produced by the addition of carmine. The violet coloured was also produced by a lake and the pearl white. It appears that no other white pigment can be substituted for the bismuth, as no other has an equal body, and is at the same time suitable to form the ground for the organic pigments, with which alone the delicate colours of some fine coloured sealing waxes can be produced. Carbonates like white lead and chalk are not at all suitable, as they froth when melted with the bleached shell-lac, apparently by the resin combining with the base, and driving off the carbonic acid. Magnesia is sometimes prescribed for the preparation of coloured sealing waxes, but zinc white would evidently be better adapted for the preparation of a cheaper though less beautiful product than that which could be made with the bismuth.—*Journal für praktische Chemie, Bd. 62, p. 383.*

Use of Gutta Percha and Caoutchouc mixed with Oils as Lubricating Agents.—M. Nickels has patented a number of mixtures of fats with gutta percha and caoutchouc for lubricating machinery. His process consists in rolling these materials into thin sheets, which are placed in a quantity of oil sufficient to cover them, and are then heated until they are dissolved, the remainder of the oil and fat being then added, and the whole mixture well stirred.

No. 1.—200 lbs. of palm oil	or No. 2.—200 lbs. of palm oil
66 " fish oil	100 " fish oil
40 " tallow	15 " caoutchouc
15 " caoutchouc	15 " gutta percha
15 " gutta percha	230 " clay or talc powder

No. 3.—A better kind of Machine oil.	or No. 4.—A better and more fluid oil.
204 lbs. of fish oil	210 lbs. of fish or other oil
10 " caoutchouc	14 " caoutchouc or gutta percha
10 " gutta percha	

—*Rep. of Pat. Inventions.*

The manufacture of Albumen from Blood.—According to Professor Scherer, of Würzburg, the preparation of albumen from blood in Paris, for attaching ultramarine and similar pigments to textile fabrics, consists simply in allowing the blood to flow into tanks under the slaughter-houses, where it is allowed to remain until the clot has separated. The supernatant liquor containing the albumen, in a soluble condition, is then drawn off, and allowed to evaporate spontaneously at

all periods of the year. The product of the evaporation is not pure albumen, but answers as a fixing material for ultramarine. A purer but dearer kind is also made at Paris from the white of egg by evaporation. Immense quantities of blood are annually run into the sewers in Ireland, which might be turned to very good account in this and many other ways. As long, however, as the present system of slaughter-houses scattered through all the lanes in the hearts of our cities and towns is allowed to continue, we cannot hope for the utilization of the blood or any other waste effluvia, which contributes to pollute the sewers and rivers. —*Würzburger Gemeinnützige Wochenschrift*, 1854, No. 35, through *Polytechnisches Journal*, Bd. cxxxiii., Heft. 4.

Action of certain Salts upon Glue.—Hyltén Cavallius has published the results of a great number of experiments upon the behaviour of glue with certain salts, of which we shall notice those of practical importance.

If carbonate of potash, neutral tartrate of potash, carbonate of soda, the double tartrates of potash and soda, sulphate of magnesia, or other salts, be added in the form of powder to a lukewarm solution of glue, made with from four to six times its weight of water, the gelatine will be coagulated, apparently displaced mechanically from the solution by the salt. Dilute solutions of these salts do not precipitate a solution of glue containing common salt. 2. If a warm solution of lime (in six or more times its weight of water,) be saturated with chloride of sodium, chloride of ammonium, chloride of barium, nitrate of potash, bi-chromate of potash, &c., it will not gelatinize on cooling; saturated solutions of these take up, although slowly, dry glue. 3. If a lukewarm, very strong solution of glue, (consisting of 1 part of glue to 3 parts of water,) be treated with a concentrated solution of alum or other alumina salt, the glue will be partially precipitated as a transparent, colourless, stiff mass. A more dilute solution of glue (1 part of glue to 12 of water) becomes very tenacious by the addition of a solution of an alumina salt; if, however, a large quantity be added at once, the action is less marked. A very slight addition of acid, as, for example, acetic acid, prevents all action of alumina salts. Glue behaves in exactly the same way towards persalts of iron, except in the colouring of the precipitate. The precipitates are combinations of glue with alumina and peroxide of iron. If, therefore, a solution of glue saturated with common salt be mixed with alumina or salts of peroxide of iron, about $\frac{1}{500}$ of the glue will still be precipitated, and if some colouring matter be added to the alum solution a very slight precipitation of glue will be still more easily distinguishable. Glue containing salts of alumina is not very binding, or, as it is expressed, has not much strength; hence the employment of a solution of alum for clearing glue should be avoided. 4. A warm solution of glue does not gelatinize on cooling on the addition of dilute acids, such as hydrochloric, sulphuric, nitric, tartaric, citric, and solution of indigo in sulphuric acid, but if it be now saturated with common salt, colourless or coloured coagulums will be formed. These are most readily formed if the acids named be added to a clear solution of glue, and salt. 5. If glue be dissolved in six times its weight of a strong decoction of certain dye-woods, such as Brazil wood, logwood, &c., then heated, and treated with a solution of bi-chromate of potash, the whole fluid will solidify into a dark insoluble jelly. If a solution of glue be treated with copperas or sulphate of iron, and then with bi-chromate of potash, it will be precipitated as a brown insoluble mass. If cuttings of glue containing a sufficient quantity of the above mentioned colouring matter or sulphate of iron, be placed in a cold solution of bi-chromate of potash, the glue will be found to remain undissolved. Upon this fact M. Hyltén Cavallius bases a method of quick tanning, a dyeing and mineral tanning. 6. A solution of glue boiled for some minutes with slaked lime loses the property of gelatinizing, and yields, on the evaporation of the water, a gum-like colourless mass, soluble in cold water and in a saturated solution of common salt, the solution in the latter case giving with salts of alumina a precipitate soluble in pure cold water. This gum-like glue when mixed with a proper quantity of pure glue, yields a mixture having the properties of common carpenters' glue, which, when dry, forms an unpliant glassy mass, and becomes moist at certain seasons, and glutinous between the lips, and is partially soluble in cold water. It is well known that such a gum-like substance is produced in

common glue during the long boiling to which it is usually subjected during its preparation, and also partially owing to the action of the caustic lime remaining in the fleshings, &c., used for making the glue, and which is not always removed with sufficient care. Sometimes the glue cannot be brought to gelatinize, which is often attributed to the unfavourable nature of the weather, especially the influence of thunder; but more generally the true cause is the presence of caustic lime, which ought to have been removed or neutralized.—*Oefvers. af Vetensk. Akad. Förhandling*, 1853, No. 788, p. 166.

Dyeing Bone and Ivory Red.—Killermann has published the following method of dyeing bone, ivory, &c., red. The object is first placed in a bath composed of one-half a litre of soft water, and 13 grammes of nitric acid, and allowed to soak in the cold during 20 to 25 minutes; the bath is then warmed, and the objects again soaked during 10 to 12 minutes. The objects are next removed from the acid bath, and placed in another containing half a litre of water, to which is added, under rapid stirring, a portion of salt of tin about the size of a grain of rice; at the end of 30 minutes the objects are introduced into an almost boiling bath composed of 4.5 grammes each of log-wood and fustic and half a litre of water. When the objects have assumed a clear yellow tint, which occurs at the end of about 5 minutes, at most, they are introduced into the dye bath, which is prepared in the following manner:—a little of the finest red carmine is taken upon the point of a knife, and dissolved in from 6 to 8 drops of caustic ammonia, heated gently, or allowed to rest exposed to the air during an hour, a half litre of water added, and the objects to be dyed placed therein, and the whole then boiled; when the objects have become red they are dipped in the acid bath, in which they were first soaked, and then again placed in the dye bath; at the end of a few minutes the operation is terminated, and the objects require merely to be removed from the bath and dried in the air.—*Oesterreichisches Gewerbeblatt*, Heft. 2, p. 53.

Artificial Whalebone.—Under the name of *Wallofin*, M. Th. Völker, of Meissen, in Saxony, prepares a substitute for whalebone, now gradually becoming dearer, which has all the elasticity of the natural fish bone, at the same time that it is not influenced by moisture, so that rods of it may be steeped for any length of time in water without becoming soft. It may be polished, turned, and bored, and recommends itself especially to umbrella makers by its cheapness.—*Deutsche Gewerbezeitung*, 1854, Heft. 2, through *Polytechnisches Centralblatt*, Lief. 16.

Application of essence of Coal as a substitute for Oil of Turpentine.—M. Pelouze, the son of the distinguished chemist of that name, proposes to use an oily fluid consisting of a mixture of carbo-hydrogens, especially of benzine, &c., as a substitute for oil of turpentine in painting. He obtains this fluid, which boils from 100 to 168° centigrade, by the distillation of cannel coal, by means of sur-heated steam. This liquid is colourless, very fluid, and completely volatile, leaving no stain upon paper, and is not altered by exposure to the light. It has a penetrating smell, which reminds one of common coal gas, but this entirely disappears when it has evaporated. A number of comparative experiments have been made, with the object of comparing it with oil of turpentine, by a committee of the *Société d'Encouragement* of Paris, all of which have resulted in showing that walls, wood work, &c., painted with paints made with the essence of coal, dried far more rapidly, and the smell disappeared sooner, than where essence of turpentine was employed. For example, in one case where the coal essence and oil of turpentine were respectively mixed with three times their volume of oil, and employed under exactly similar circumstances, the smell of the essence of coal was completely dissipated at the end of three days, while that part painted with the turpentine mixture had still a strong smell, and was not completely dry. The introduction of such an oil would be of great importance, not only in a commercial point of view, but in a hygienic one also.—*Bulletin de la Société d'Encouragement*, June, 1854, p. 344.

Chemical Arts among the Chinese.—M. Stanislas Julien, the celebrated Orientalist, has announced to the *Société d'Encouragement* of Paris, that he has collected in one volume, which he is about to publish, the description of the Chinese processes connected with the chemical arts.

MISCELLANEOUS.

Iron Shutters.—Charles Reed, of New York, has patented an improvement in rolling iron shutters. The improvement consists in bending or otherwise forming the slats, so as to produce a recess in the form of part of a circle within each edge of the back side, one of such recesses being for the purpose of receiving the joints of the hinges or chain to which the slats are attached, and preventing it from causing so great a protuberance as is usually the case on the back side, the other being for the purpose of receiving the prominence on the front, which is caused by the recess on the back of the next slat. The circular interiors of the recesses and the exterior prominences of the slats are concentric to the axes of the joints or hinges, and fit together in such a way as to allow the free working of the joints, and at the same time strengthen them. When the shutter is unrolled the prominences on the exterior of the slats have the appearance of a number of parallel beads, which conceal the joints, and give the shutter an ornamental appearance on the outside.—*Scientific American*, May 27th, 1854.

Application of the Electric Light.—During the last winter 800 men were employed at the Napoleon Docks at Rouen, and in order to enable them to work part of the evening, M. Regnault, Telegraph Director of the Paris and Rouen Railway, proposed to light the works with two electric lights, which was accordingly done during four months with great success. Two apparatus, made by Deleuil & Son of Paris, were employed, each consisting of a battery of 50 Bunsen-Elements of a large size. According to the account presented to the French Academy by M. Regnault, the cost for working each apparatus per day was as follows:—

Wages of attendant ...	...	...	4:50 francs
Quicksilver ...	...	..	5:00 "
Zinc ..	...	..	4:50 "
Graphite rods ...	...	...	1:40 "
Nitric acid ...	..	...	1:80 "
Sulphuric acid ...	...	...	1:84 "

Total 19:04 francs,

or for the two, 38 francs 8 centimes; that is, the light necessary for the 800 men cost £1 11s. 4d., or less than one halfpenny per man. The economy was therefore considerable, and the men were able to work with the greatest regularity and without the slightest danger.—*Comptes Rendus de l'Academie*, No. 18, May, 1854.

New Plastic Material from Peat.—MM. Delettre-Gras, who are well known in connexion with the applications and preparation of peat, have patented a peculiar kind of plastic material applicable to a great many industrial and artistic purposes. It consists of a mixture of carbonized peat reduced to powder and liquid tar more or less purified, according to the objects which it is proposed to execute in it. Thus, for objects having very delicate or complicated forms or contours, the charcoal is reduced to an extremely fine powder, and mixed with the tar perfectly purified, in the proper proportions, according as it is intended to make a more or less compact mass, or a sort of thick liquid. In the first case the material may be moulded by pressure, in the second, by pouring it into the moulds as plaster of Paris or different metals are cast. The material may be employed cold or warm, but it is better to heat it to a certain degree. In the case of very small objects, such as cameos, several successive coats may be laid on with a brush. In making large objects it is not necessary to make the charcoal very fine, nor to employ purified tar, as common tar, and that even of an inferior quality, will answer when mixed with the proper quantity of charcoal, some glue being added if required. Any gelatinous, gummy, or resinous materials may be substituted for the tar, and may accordingly be often advantageously used in certain cases, according to the nature of the object to be formed. Other carbonaceous matters may also be substituted for the peat charcoal. MM. Delettre-Gras have been able to produce casts of very delicate and fine objects, such as statuettes, architectural ornaments, and even small ornamented buttons. They have also executed several large objects, and have no doubt but that all objects

cast in iron, bronze, plaster, wax, or earthen-pierre, or those cut or chiselled, may be formed with perfect truth in this very durable material. The mass may be made of different colours by mixing up colouring materials with the fused mass.—*Le Génie Industriel*, July, 1854.

Zincography.—M. Dumont, 17, Rue Dauphine, Paris, has described, under the name of zincography, a process of electrical engraving of some promise. He designs some particular subject with a sort of lithographic crayon upon a thick plate of zinc, planed and rubbed with fine sand, by means of a steel tool. He then spreads over the design a fine powder, composed of resin, Burgundy pitch, and bitumen of Judea; on heating the zinc plate the powder melts, and is transformed into a varnish, which spreads itself over the parts of the surface which have been covered with the fatty crayon, that is, upon what constitutes the design. In order to etch the plate and obtain the design in relief, he places it in a bath of sulphate of zinc in communication with the positive pole of a battery having another plate in communication with the negative pole opposite to it. The current passes and corrodes or etches the zinc which is not covered with ink, by which the design is brought out in relief. A cast is then taken in gutta percha, upon which a copper plate is deposited, with which proofs can be printed by the ordinary printing-press. M. Dumont's process is a new application of a principle already utilized by M. Beuviere, and which M. Baldun has successfully put in practice in his attempts at photographie engraving.—*Moigno's Cosmos*, 5th vol., 10 livr., p. 292.

Thermography, a new kind of Printing.—M. Felix Abate, of Naples, has found that wood when impregnated with acid and pressed in contact with a piece of paper, will impress a copy of its surface upon the paper, which will be rendered visible and fixed by the action of heat. His process is as follows:—Suppose a sheet of veneering wood be the object from which impressions are to be taken, it is to be exposed for a few minutes to the cold evaporation of hydrochloric or sulphuric acid, or it may be slightly wetted with either of these acids diluted, and the acid then well wiped from the surface. Afterwards it is laid upon a piece of calico, or paper, or common wood, and by a stroke of the press an impression is taken, which is of course quite invisible; but by exposing this impression immediately after to the action of a strong heat, a most perfect and beautiful representation of the printing wood instantaneously appears. In the same way, with the same plate of wood, without any other acid preparation, a number of impressions, about twenty or more, are taken; then as the acid begins to be exhausted, and the impressions faint, the acidification of the plate must be repeated as above, and so on progressing, as the wood is not in the least injured by the working of the process for any number of impressions. All these impressions show a general wood-like tint, most natural for the light coloured woods, such as oak, walnut, maple, &c.; but for other woods that have a peculiar colour, such as mahogany, rosewood, &c., the impressions must be taken, if a true imitation be required, on a stuff dyed of the light colour of the wood. The impressions thus made show an inversion of tints in reference to the original woods, so that the lights are dark, and *vice versa*, which however does not interfere with the effect. This arises from the fact, that all the varieties of tints which appear in the same wood are the effect of the varying closeness of its fibres in different parts, so that where the fibres are close the colour is dark, and light where they are loose; but in the above process, as the absorption of the acid is greater in proportion to the looseness of its fibres, the effect must necessarily be the reverse of the above. When, however, it is desired to produce the true effect of the printing wood, the following process is adopted: The surface upon which the impression is to be taken is wetted with dilute acid, and is then printed upon with the veneering wood previously wetted with diluted liquid ammonia; it is evident that in this case the alkali neutralizing the acid, the effect resulting from the subsequent action of heat will be a true representation of the printing surface.

Thermography may perhaps prove useful to the decorative arts, particularly in the production of imitations of rare and costly woods, mosaics, inlaid work, &c. for paper hangings, or for furniture in place of veneering.—See *Journal of the Society of Arts*.

Employment of Basalt, &c., for the manufacture of Pipes, &c.—About two and a half years ago a Mr. Adcock took out a patent for the application of basalt, lava, and other similar materials to make water pipes, bricks, architectural ornaments, &c. His process consisted in melting the basalt in a reverberatory or other furnace, and casting the melted rock in iron moulds, the interior surfaces of which have been rubbed with plumbago where a smooth surface is required, and with charcoal in fine powder rubbed up with water, in ordinary cases. We have not since heard whether this process has been successful on a large scale. If so, it would be worthy of the attention of persons connected with localities where basalt and similar rock is abundant, such as in the Counties of Antrim, Limerick, &c. There would be an unlimited field for large water pipes made of such a material, which would be practically imperishable.

PROCESSES CONNECTED WITH FOOD, RURAL ECONOMY, AND AGRICULTURE.

Improved Rotary Cultivator.—H. M. Johnson, of Carlisle, Pennsylvania, has obtained a patent for an improved rotary cultivator. It consists of a firm frame, upon which are supported three axles, carrying a number of circular knives or coulters. The first axle has six simple circular coulters, made of the usual plough steel or other substantial metal, made as thin as is consistent with due strength. The exterior portion is slightly thicker than the interior portion, and is bevelled off to an edge. They are keyed on the axle, so that the width apart may be varied to suit the soil to be cut. The second set consists of only three coulters, and the third of two, being so placed that each of the second set come between each two of the first; and each of the third in the spaces between those of the second. The coulters of the second and third series have a number of knives or wings projecting laterally from their edges at such an angle, that when the wheel revolves they descend edgewise with the least practical resistance, and come up flatwise, bringing up the earth from the bottom of the cut. The first set simply cut the soil into longitudinal ridges, while the winged coulters tear up these ridges. The advantages of the circular form of knife is, that all hard substances, such as loose stones, are pressed one side, and they can be made adjustable, so that if one breaks it may be conveniently replaced, and a greater number of coulters may be employed if found desirable. The whole frame work can be attached to a carriage, so that it may be lowered or raised at pleasure, when formidable obstacles are presented. The patent also provides that each coulters or wheel may have a separate axle, and play up and down under the pressure of a weight or spring, thus readily adjusting itself to uneven surfaces.

New Butter Worker.—Ezekiel Gore, of Bennington, Vermont, has patented a new machine for working butter, which consists in placing the butter within an endless sack or bag, which revolves between fluted rollers in such a manner that the butter is constantly being operated upon by the rollers. One portion of the sack passes through water, so that the butter may be washed as often as it is considered desirable.—*Scientific American*, September 9th.

The chief cause why butter becomes rancid is the presence of sugar of milk and of caseine or curd, both derived from the milk imperfectly washed out of the butter. The latter soon reacts upon the sugar of milk and produces lactic acid, and the change once commenced soon induces another series of changes in the butter, which thus becomes rancid. Many samples of butter coming into market contain from 3 to 7 per cwt., and in some cases even considerably more of these ingredients. Very good butter does not usually contain as much as one per cent. The idea contained in the patent just noticed is, therefore, well worth the attention of agriculturists, as it would be most desirable that the butter intended for exportation, and especially that destined for Portugal, the West Indies, and other warm climates, should be washed as free as possible from butter milk. Sooner or later the American farmers will so improve their butter by mechanical contrivances, like that just described, that they will be formidable rivals in many of our best markets at present. Those interested in the butter trade ought to look to this in time.—Ed.

Improvement in the Barrels for shipping American Flour.—When freshly ground

meal or flour, which is always more or less damp, is packed in barrels, it is liable to heat and become sour. This takes place usually in the centre of the mass, while the external portion may remain unchanged and quite sweet. Mr. Thomas Pearsall, of Smithboro', Toga Co., New York, proposes to prevent this heating by introducing a tube into the centre of the barrel, 2½ inches in diameter. This tube passes through both heads, and is like a hollow axle; the air passing through it keeps the flour from heating.—*Scientific American*, June 3rd, 1854.

Breeding Leeches.—A general fever appears to have seized upon the great and small proprietors of the Gironde for rearing leeches. At this moment more than 2,000 hectares of leech marshes have been, or are forming, in the Bordelais. Some are even being formed close to the city of Bordeaux, and in many instances land which had once been marshy, and had been drained and brought into cultivation, has been again converted into marshes for the purposes of this new branch of industry, of which we have indicated the origin in No. IV., p. 126, of this JOURNAL. In some of these marshes the leeches are fed upon horses, in others, cows, or bladders filled with blood. Some keep the leeches always in water, others place them on dry ground during their breeding period. M. Chevallier is about to publish a report on the whole industry.—*M. Barral's Report to the Société d'Encouragement on the Industrial Exhibition of Bordeaux*, Bulletin, &c., for July, p. 403.

Mode of determining the relative value of different samples of Potatoes.—In No. VI., p. 182, of this Journal, we drew attention to the fact that the relative specific gravity of two roots bears an approximate ratio to the amount of solid matter which they contain, and also to the practical application of this fact by the potatoe-starch-makers of Germany, to determine the relative value of potatoes for their purposes, and by M. Vilnuorin to determine the amount of sugar in beet. M. Krocke proposes this method to determine the per-centage of starch in potatoes. His process is very simple, the only instruments required being a ladle, an earthen vessel of moderate size, and a small areometer. The vessel is half filled with clean water, and a quantity of salt ladled into it to saturate it. When the whole of the salt has dissolved, twenty potatoes of the kind to be examined are well washed and thrown into the pot, where they will float on the surface of the brine; water is then added and the liquid stirred slightly until ten of the potatoes shall have sunk to the bottom of the vessel, the density is then ascertained by the areometer, and by means of a table the amount of starch will be found. The reason for taking twenty potatoes is because the individual potatoes of the same kind exhibit small variations in specific gravity, when, therefore, one-half of that number floats in a given solution, and the other half sinks, we may consider that a pretty approximate average density may be thus estimated. The following is the table by which the per-centage of starch and solid matter may be ascertained where the average density is determined, founded upon M. Krocke's experiments:—

100 lbs. of potatoes contain—

When the specific gravity is	of Starch,	of Solid Matter,
1.130	26.00 lbs.	34.00
1.125	24.75 "	32.60
1.120	23.50 "	31.38
1.115	22.25 "	30.12
1.110	21.00 "	28.90
1.105	20.00 "	27.60
1.100	18.75 "	26.38
1.095	17.50 "	25.12
1.090	16.38 "	24.00
1.085	15.25 "	22.75
1.080	14.00 "	21.60
1.075	13.00 "	20.38
1.070	11.75 "	19.25
1.065	10.60 "	18.12
1.060	9.50 "	17.00

Le Génie Industriel, July, 1854.

Chemico-Physiological action of Coffee.—Dr. Julius Lehmann gives the following as the results of his experiments upon the action of coffee as an article of diet:

1. The use of a decoction of coffee produces two effects upon the body which are very difficult to unite—it causes the assimilation of the food to take place slower and produces a greater activity of the nervous and circulatory systems.

2. It enlivens the activity of the mind, a general feeling of well-being and elevation of spirits are produced by the mutual modification of the special actions of the empyreumatic oil and of the caffeine.

3. The retardation of the assimilation is chiefly owing to the action of the empyreumatic oil; but the caffeine also acts similarly when large quantities of it are taken.

4. Increased action of the heart, trembling, suppression of urine, headache, a peculiar intoxicated state and delirium, are the results of the action of the caffeine.

5. Increased function of the perspiratory glands and kidneys, acceleration of the peristaltic motion, elevation of the activity of the understanding, congestions, restlessness, and loss of sleep, are produced by the empyreumatic oil.—*Liebig's Annalen*, lxxxvii. 205, 275.

ART. IV.—*Bulletin of Industrial Statistics.*

STATISTICS OF THE PAPER TRADE IN IRELAND, ENGLAND, AND SCOTLAND.

IN 1850 the Revenue Returns gave the number of paper mills in Ireland at 37; the number of beating engines at 86; the number of vats at 18; and the number of machines at 32; the quantity of paper produced at 6,719,502 lbs; and the duty received at £44,096. In the same year there were 327 mills in England; 1,374 beating engines; 307 vats; 323 machines; 105,712,953 lbs. of paper produced; and £693,741 paid as duty. And in Scotland, 51 mills; 286 beating engines; 49 vats; 57 machines; 28,600,019 lbs. of paper made; and £187,687 paid as duty. According to a parliamentary paper published in 1852, there were only 304 of those mills at work in February of that year in England, 48 in Scotland, and 28 in Ireland, in which there was a total of 1,616 beating engines at work, and 130 idle. These figures show that the greater number of the mills in Ireland are small, and that they are not worked regularly; for while the number of mills and machines is more than half, and the number of vats nearly equal to those in Scotland, the quantity of paper made was only one-fourth of that produced in that country.—*Irish Industrial Exhibition of 1853—Article, Paper.*

RELATIVE IMPORTANCE OF THE FLAX SPINNING INDUSTRY IN DIFFERENT COUNTRIES.

The following table contains an approximate estimate of the number of spindles employed in flax spinning in the different countries named:—

Ireland,	580,000 spindles.
England,	345,000 "
Scotland,	303,000 "
France,	476,000 "
Belgium,	102,000 "
German States, included in Zollverein,	80,000 "
Austria,	74,000 "
Russia,	50,000 "
United States of America,	14,500 "
Switzerland,	8,000 "
Holland,	6,000 "
Spain,	6,000 "

— *Ibid.*—*Article, Manufactures from Flax, by J. MacAdam, Junr.*

1. The first part of the document is a list of names and addresses of the members of the committee. The names are written in a cursive hand, and the addresses are written in a more formal, printed hand. The list is organized in two columns, with names on the left and addresses on the right. The names are: John A. Smith, James B. Jones, William C. Brown, and Thomas D. White. The addresses are: 123 Main Street, New York, N.Y.; 456 Elm Street, Boston, Mass.; 789 Oak Street, Philadelphia, Pa.; and 101 Pine Street, San Francisco, Calif.

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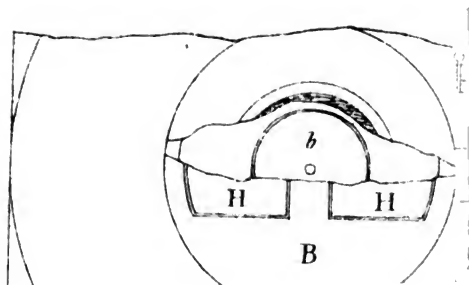
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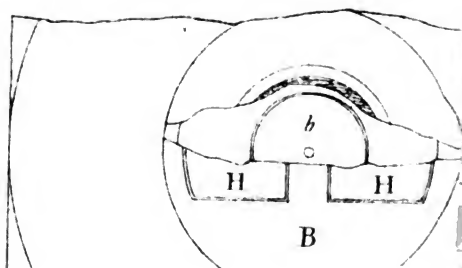
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THE
JOURNAL OF INDUSTRIAL PROGRESS.

No. XII.—DECEMBER, 1854.

ART. I.—*On the uses to which Turf might be applied in Ireland.* No. 3.
Products of the Destructive Distillation of Peat. Part I.

THE UTILIZATION OF THE WASTE GASES FROM HIGH FURNACES CHARGED
WITH PEAT.

THE gases which escape from the throat of an iron furnace have a very high temperature, perhaps as much as from $1,700^{\circ}$ to $1,800^{\circ}$ Fahr., and hence, very soon after the introduction of the hot blast in 1829, attempts were made to apply these hot gases to heat the blast, and thus economize a certain amount of fuel. In addition, however, to the gases being in this hot condition, it was soon observed that they were combustible, and that even after having been cooled down in heating the blast, they might be burned, and an additional source of heat obtained. Up to a recent period, however, but little advantage appears to have been taken of this important fact in Great Britain, the greatest iron-making country in the world; chiefly owing, it is to be supposed, to the abundant and consequently cheap supply of fuel, which rendered it scarcely worth a manufacturer's while to endeavour to overcome the great difficulties which beset the economization of the waste gases in the first instance.

In France, Germany, and Sweden, where fuel is very dear, it attracted, on the other hand, immediate attention. Even so early as 1836 an attempt was made at Wasseraufingen, in Germany, to puddle iron by means of the combustion of the waste gases; and in the same year a patent was likewise granted in France to a M. Sire, who made some trials at Clerval. Subsequently to these trials, the Messrs. de Dietrich, of Neiderbrunn, whose names are honourably connected with improvements in the manufacture of iron in France, made a great number of experiments upon the best method of collecting the waste gases, and of applying them to the purposes of iron puddling. Later still, further improvements were effected in the modes of burning the gases in puddling, the most important of which was the employment of heated air, which was made to

play on the hearth, and the iron thus more rapidly decarbonized. All these attempts were, however, only partially successful, in consequence of the difficulty of collecting the gases without interfering with the proper working of the furnaces, and of then regulating the proper supply of air necessary for their combustion.

In 1841, MM. Thomas and Laurens, who are among the most distinguished engineers of France, put up a puddling furnace at Treveray, which, although far from perfect, gave an immense impulse to the application of the waste gases, which are now employed on the Continent to roast ores, burn lime, raise steam for working the blowing engines, and in the refining and puddling processes. In Great Britain, too, their use is at length beginning to be appreciated, especially in Wales and in Scotland, and no doubt can exist that before long, the great improvements which have been effected in the modes of collecting the gases and in their subsequent application, joined with the increasing cost of fuel, will lead to the general adoption of closed furnaces, and the utilization of all the waste gases throughout England and Scotland.

While the attempts of which we have above spoken were being made to utilize the waste gases, the late M. Ebelman, the distinguished director of the Porcelain Works of Sevres, conceived that if the waste gases of an iron furnace could be advantageously employed as a fuel, he might directly obtain a supply of similar gases, by burning small coal, peat, or other inferior fuel in a special furnace, from which the gases might be conducted to those points where they would be required. In this way he hoped that pyritic and shaly coals, and all similar carbonaceous substances, which could never be employed directly as fuel in the manufacture of iron or glass, &c. might be utilized. This ingenious idea, which held out so many advantages to districts having in their seams of inferior coal or abundance of peat, does not seem to have immediately led to the practical results which might naturally have been anticipated. Recently, however, the case has been different, and there is at present at Ilseburg, in the Hartz, a gas puddling works most successfully carried on, the gas for which is obtained with turf, the cones of the pine, and sometimes even the bark, dried weeds, &c. are employed.

In 1849 Mr. Rees obtained a patent for an ingenious development of this idea of Ebelman. When we distil wood, peat, or coal, we obtain three classes of products, namely tar, a watery fluid, and gas. If the temperature at which the distillation is effected be low, the tar will yield, together with certain oils, a quantity of a solid fat-like substance, termed paraffine, and will be more or less solid; if the temperature, on the other hand be high, the tar will be more liquid, and will yield but little paraffine, which will be replaced by oils of analogous composition. In the aqueous liquor is found ammonia, and in the case of wood and turf, acetic acid and methylic alcohol, also called wood spirit or naphtha. The gas consists of a mixture, in varying proportions, of carburetted hydrogen, olefiant gas, and vapours of substances which would be liquid at a very low temperature. Peat, as usually obtained and air-dried, contains a large quantity of water, so that if we expose it to the process of distilla-

tion, the presence of this water will keep the temperature very low until a considerable portion of the volatile products will have passed off, and hence the tar will be rich in paraffine, and consequently almost solid.

M. Ebelman's process for obtaining gas is a species of distillation. If a quantity of peat or coal be introduced into a furnace, and the bottom be kindled and a blast of air made to act upon it, the under stratum will be consumed, and will yield a body of intensely heated gas, which in its passage upwards will coke, that is, distil, the superincumbent layers; the tar and aqueous products being volatilized and carried off. The coke thus formed will gradually sink in the furnace, and serve to replace that burned away, while fresh fuel is filled in on top, and is in its turn distilled. Now Mr. Reece proposed, by the patent alluded to, to collect the tar and aqueous products carried off along with the gas; and while the gas formed the primary and sole object of the process of M. Ebelman, it formed only the secondary object in the patent of Mr. Reece, the primary one being the tar and aqueous products.

According to the original specification (sealed the 23rd of January, 1849) the peat was to be burned in blast furnaces, in the bottom of which was to be placed a grating or set of fire bars, under which the nozzles of the tuyeres were to be inserted, by which the blast was to enter,—the pressure of the blast proposed to be employed being from 2 to $2\frac{1}{2}$ lbs. on the square inch. Each furnace was to be provided at top with a cover, which was to be raised whenever the furnace required to be charged, an operation which was to be performed at intervals, care being taken that the charge in the furnace did not descend so low as to go out. When the furnace was closed with its cover, the gas and other products of the distillation were to be conducted off by pipes leading from the upper part of each furnace, and dipping into water contained in a closed trough, in the manner of a hydraulic main in a gas works. A portion of the tar and aqueous products would be deposited in this box, but the greater portion would still remain in the state of vapour, and hence the gas was to be conducted through a series of pipes, forming a kind of great worm immersed in water, where they were to be deposited, and thence allowed to flow into a proper receiver, whilst the gases and non-condensable vapours, on their exit from the condensing apparatus, were to be conducted to the several flame beds where they were to be burned.

From the tar Mr. Reece proposed to prepare paraffine, which might serve as a substitute for spermaceti in the manufacture of candles, and a number of oils, and from the aqueous liquor, naphtha, sulphate of ammonia, and acetate of lime. In the separation and purification of these various products heat would naturally play a very important part, and a considerable quantity of fuel would accordingly be required, but this fuel, Mr. Reece hoped, would be supplied by the waste gases, which he proposed to employ as the sole fuel in raising steam for working the blowing cylinders for distilling his tar, and in the purification of his oils and paraffine, and in the separation of the other products.

This was the most novel part of the idea, for a factory worked upon this principle would be a kind of automaton. The peat put into the

furnace having been first distilled, so as to yield its tar and water, would descend as charcoal into the body of the furnace, where it would act as fuel to carry on the distillation of fresh peat. There it would be resolved into combustible gases and ashes, the latter being removed from time to time, while the gases would go to raise steam to work the blast, and carry on all the other operations. The furnaces would thus be the centre of action, and if these ceased to work all other operations would cease simultaneously.

To carry out this novel manufacture a company was formed under the title of the Irish Peat Company, with limited liability, under a royal charter of incorporation. The following statement from the prospectus of this Company represents the commercial results which its promoters expected to realize from the working of a factory capable of consuming 100 tons of peat in the twenty-four hours, or 36,500 in a year, and which, it further stated, could be erected and worked for the sum of £10,000:—

Expenditure.

36,500 tons of peat, at 2s. per ton,	...	...	£3,650
455 tons of sulphuric acid, at £7 per ton,	...	...	3,185
Wear and tear of apparatus, &c.	...	...	700
Wages, labour, &c.	...	...	2,000
Cost of sending to market and other incidental charges,	...	...	2,182
			<hr/>
			£11,717

Produce.

365 tons of sulphate of ammonia, at £12 per ton,	...	...	£4,380
255 tons of acetate of lime, at £14	...	...	3,570
19,000 gallons of naphtha, at 5s.	...	...	4,750
109,500 pounds of paraffine, at 1s.	...	...	5,475
73,000 gallons of volatile oil, at 1s.	...	...	3,650
36,000 gallons of fixed oil, at 1s.	...	...	1,800
			<hr/>
			£23,625

Which would leave a nett profit of £11,908, or a little more than 100 per cent.

The idea of obtaining so enormous a profit from a manufacture having for its raw material turf, a substance which had hitherto offered so narrow a field for speculation, notwithstanding the innumerable projects set on foot in connexion with our peat bogs, naturally excited the most lively interest, especially at a moment when the country had scarcely yet begun to emerge from the desolation caused by famine and disease. It was accordingly considered advisable to test by experiment the accuracy of the statement put forward in the prospectus of the company with regard to the amount of products which could be obtained from a given weight of turf. For this purpose a long series of experiments was instituted in the laboratory of the Museum of Irish Industry, upon a great variety of peats, from different parts of the great central bogs of Ireland. Only a certain number of these were distilled on a large scale, the density, amount of nitrogen, and composition of the ash, and the amount of charcoal and

volatile products yielded by them, were alone determined in the case of the remainder. We shall give a summary of all the results obtained in the case of the former, and leave those of the latter entirely out of consideration.*

The great bogs in the centre and west of Ireland are very similar in character, and are of remarkable depth, often averaging from 20 to 36 feet. The peat of these bogs is usually of three kinds: 1, an upper stratum of soft spongy moss turf, of a pale colour, and composed almost exclusively of bog mosses; 2, a middle layer of brown peat, more or less earthy, containing many remains of roots and stems of trees and other plants, especially of heath; and 3, an under layer of black compact peat, devoid of all vegetable structure. The upper surface or flow peat varies very much in thickness, according to the nature of the bog and the part of it, being in some places only a few inches, and in others several feet. The brown turf constitutes the great mass of the bog, and gradually passes into the black, which, in the lower layer, close to the clay or gravel upon which it rests, gets intermingled with a portion of the subjacent clay or gravel, and when burned consequently leaves a large quantity of ash. None of the peats of which we are now about to speak had this character; some were very black, but should nevertheless be considered merely as the under layers of the brown turf, the kind usually employed as fuel.

The number of samples of peat subjected to distillation was six, of which the following table contains the name of the locality, the description, and other particulars.

No. of Specimen.	Specific Gravity.	Description.	Locality from whence obtained, and character of bog.
1 A mixture of equal weights of both kinds.	0.405	Light surface peat of a pale reddish brown colour, containing small roots of heath, and leaves of grasses and of bent.	1. Both specimens were obtained from Mount Lucas Bog, lying one mile south of the town of Phillipstown, in the King's County. According to Griffith's Survey, made in 1810, this bog covers 6,582 acres. Its highest point above high water of Dublin Bay, 294 feet, and lowest point 214 feet, and its average thickness 18 feet. The entire district about this town is covered with bogs averaging from 1,000 to 8,000 acres each in extent, and having an average depth of from 18 to 20 feet.
	0.669	Rather dense peat, of a dark reddish brown colour, structure of moss, still distinguishable, but species difficult to be determined.	
2	0.335	Light surface peat, of a pale yellowish brown colour, very open-grained and fibrous. Principally com-	2 and 3. From the Wood of Allen, which forms part of the great Timahoe Bog, lying to the north east of the Grand Canal. The specimens were

* See Parliamentary Report on the Nature and Products of the process of the Destructive Distillation of Peat, by Sir Robert Kane; and the Appendix thereto, containing the account of the experiments and processes employed, and the tables of the results, by Sir Robert Kane and William K. Sullivan.

No. of Specimen.	Specific Gravity.	Description.	Localities from whence obtained, and character of bog.
3	0.639 to 0.672	posed of species of moss of the genera, Sphagnum, Hypnum, &c., in so unaltered a condition that the specific characters could, in many instances, be perfectly distinguished. Lower layer of the same bog as the last. Mass compact and dense, colour, deep blackish brown. Fracture, earthy, appearing in some instances almost conchoidal, and exhibiting a resinous lustre when rubbed. All appearance of vegetable structure nearly obliterated.	obtained from the part of the bog close to the banks of the canal, about two miles from Robertstown, in the County of Kildare. Timahoe Bog, according to Griffith's Survey, in 1810, contains 12,878 acres. Highest point of the bog above high water, 289 feet, lowest point, 232, average depth, 25 feet.
4 and 5	0.235 0.507 to 0.598	Light reddish brown fibrous moss peat. The species of Sphagnum almost unaltered, as well as the leaves of carex and other plants, and the roots of heath.	4 and 5, From Ticknevin, in the County of Kildare, close to the 20th lock on the main branch of the Grand Canal, which here forms a kind of boundary between the Timahoe and Lullymore Bogs. The specimen was obtained from the north-eastern extremity of the Lullymore Bog, which is, in reality, but the western continuation of the Timahoe Bog, the only natural boundary being a ridge of gravel. It contains 16,247 acres. Its highest point is 256 feet above high water mark in Dublin Bay, and its lowest 214 feet. Its average depth is 20 feet, but it reaches in some places 40 feet.
6	0.276 to 0.284	A light fibrous peat, of a reddish brown colour. Evidently formed from a great number of plants. The structure of the moss was very distinct, and the species of Sphagnum and Hypnum could be readily distinguished. It contained remains of grasses and bent, with roots of heath, and bark of birch, and probably of alder. Twigs were very abundant.	6, and 7. Specimens of the peats employed as fuel in the steam vessels on the Middle Shannon, and obtained from bogs along the banks.
7	0.724 to 0.983	A very dense blackish brown compact peat, the vegetable structure of which was almost obliterated. Fracture, earthy. Full of tubes of the bark of hazel, birch, and alder, and occasionally scales of pine-bark, and leaves of bent and grass.	

Before subjecting these peats to distillation, their chemical composition was first determined, and the results contained in the following table obtained:—

*Table representing the composition of different Peats, dried at 220° Fahr.
(Exclusive of Ash.)*

Number of specimens, and locality from whence obtained.	Carbon.	Hydrogen.	Oxygen.	Nitrogen, (mean.)
1. Surface Peat, Phillipstown, ...	58.694	6.971	32.883	1.4514
2. Dense Peat, Do., ...	60.476	6.097	32.546	0.8806
3. Light surface Peat, Wood of Allen, ...	59.920	6.614	32.207	1.2588
4. Dense Peat, Do., ...	61.022	5.771	32.400	0.8070
5. Surface Peat, Ticknevin, ...	60.102	6.723	31.288	1.8866
6. Light surface Peat, Shannon, ...	60.018	5.875	33.152	0.9545
7. Dense Peat, Do., ...	61.247	5.616	31.446	1.6904

This table shows, that in a perfectly dry state there was but little real difference between the different peats examined, and that apart the influence of the state of aggregation or density, and the amount of water contained in them, they ought to yield the same results when burned or distilled.

Turf dried in the air always contains a certain amount of water, depending upon the length of time it may happen to be made, the method of storing, &c. Turf containing only ten per cent. of water would be considered exceedingly dry, and it may even contain as much as forty per cent., and yet burn. It was, therefore, necessary to determine the per-centage of water which the turfs contained immediately before subjecting them to distillation, and also the amount of charcoal and volatile matters which they would yield, on being heated in close vessels to a low red heat, and the per-centage of ash which they would leave when burned, and its composition. The following tables contain the results of these determinations:—

Table representing the per-centage of Water, Ash, Charcoal, and Volatile Matter yielded by several Peats.

Number and locality of specimens.	Water in air-dried Turf	Ash.	Charcoal	Volatile matter.
1. Surface Peat, Mount Lucas Bog, Phillipstown, ...	19.452	1.992	31.699	46.857
2. Dense Peat, Do., ...	16.394	3.305	38.247	42.054
3. Light surface Peat, Wood of Allen, ...	16.497	2.745	36.695	44.063
4. Dense Peat, Do., ...	18.003	7.898	38.768	35.331
5. Surface Peat, Ticknevin, ...	17.091	2.629	34.522	45.758
6. Light surface Peat, in Shannon, ...	21.004	2.474	35.470	41.052
7. Dense Peat, Do., ...	29.557	2.976	36.463	31.004

Table representing the composition of the Ash of the preceding Peats.

	1	2	3	4	5	6	7
Potash,	1.323	0.461	0.491	0.247	0.401	0.146	0.219
Soda,	1.902	1.399	1.670	0.496	1.330	0.466	0.855
Lime,	36.496	40.920	33.037	24.944	37.873	8.492	40.079
Magnesia,	7.634	1.611	7.523	1.285	5.127	4.702	4.035
Alumina,	5.411	3.793	1.686	0.360	0.271	10.705	0.895
Peroxide of Iron, ...	15.608	15.969	13.281	19.405	14.802	15.052	14.160
Phosphoric Acid, ...	2.571	1.406	1.438	0.242	1.257	1.557	0.632
Sulphuric Acid, ...	14.092	14.507	20.076	10.742	11.814	13.974	22.295
Hydrochloric Acid, ...	1.482	0.983	1.747	0.335	1.367	0.196	0.781
Silica, in compounds decomposable by acids, ...	3.595	1.111	2.148	1.082	1.002	12.476	1.295
Sand and Silicates, undecomposable by acids, ...	2.168	2.107	7.683	26.789	4.722	31.198	5.496
Carbonic Acid,	*7.761	15.040	8.340	13.890	19.722	—	9.101
Total,	100.043	99.307	99.608	98.817	99.688	98.964	99.843

The data contained in the preceding tables will convey a very good idea of the composition of the different varieties of peat examined, and as we proceed we shall have many occasions of referring to them.

Two different sets of experiments were made with reference to the products of distillation; in the one, the peat was distilled in a close vessel, without access of air, and in the other under the influence of a blast of air, that is, under conditions analogous, so far as experiments on a very small scale could be, with those proposed by Mr. Reece.

The distillation in close vessels was effected in an iron cylinder, closed at one end, and set horizontally in brickwork, with such an arrangement of flame bed and flues as would enable it to be made red hot; it was, in fact, an ordinary gas retort, and was closed with a mouth-piece in the same way. The volatile products evolved were conducted away by a pipe which was connected with a series of Woulfe's bottles, made of tin-plate, in which the tar and aqueous products were, in great part, deposited, the remainder being condensed by making the gas pass through a long worm placed in a barrel of cold water, after which it was collected, or allowed to go to waste as was required. The quantity of each kind of turf operated upon was one cwt., which, as the retort was very small and the turf very bulky, formed from eight to fourteen charges of the retort. The following table contains the results of these distillations:—

* The lime in peat appears to exist in great part, if not altogether, as carbonate and sulphate. Supposing the whole of the sulphuric acid to exist in combination with lime as gypsum, if we deduct this portion from the total quantity of lime we shall have the quantity which probably exists as carbonate. The quantity of carbonic acid found by experiment is, however, in nearly every case, too small to saturate the latter portion of lime; this may be accounted for by a portion of the carbonic acid being expelled from the carbonate of lime during the incineration of the peat, for peat-ash almost always contains caustic lime.

Table representing the per-centage of Tar, Water, Charcoal, and Gas obtained from the specimens of Peat subjected to distillation in close vessels.

No. of Specimens	Locality from whence obtained	Water.	Tar.	Charcoal.	Gas.
1 } 2 } 3 } 4 } 5 } 6 } 7 }	Surface Peat, } A mixture of about equal Dense Peat, } parts of the two peats, Light surface Peat from Wood of Allen, } from Mount Lucas Bog, Black compact Peat, from do., } near Phillipstown. Surface Peat, from Ticknevin, } Do. distilled with the retort heated to } a very bright redness, } Surface Peat, from Shannon, } Dense Peat, from do., }	23·600 32·273 38·102 33·628 32·098 38·127 21·189	2·000 3·577 2·767 2·916 2·344 4·417 1·462	37·500 39·132 32·642 31·110 23·437 21·873 18·973	36·900 25·018 26·489 32·346 42·121 35·693 57·746
	Average, ...	31·378	2·787	29·222	36·616

The amount of ammonia, acetic acid, and naphtha contained in the water was next determined, and the amount of oil and paraffine in the tar; the following table contains the results obtained:—

Table representing the per-centage of Ammonia, Naphtha, Acetic Acid, Paraffine, and Oils, obtained by the distillation of Peat.

Locality from whence obtained.	Ammonia.		Acetic Acid.		Pyroxy- lic Spirit, or Naphtha	Paraf- fine.	Volatile Oil.	Fixed Oil.
	Ammonia as N H ₃ .	Correspond. quantity of sulphate.	Acetic Acid as C ₂ H ₃ O ₂ + H ₂ O.	Correspond quantity of Acetate of Lime.				
1. Surface Peat	0·302	1·171	0·076	0·111	0·092	0·024	0·684	0·469
2. Dense Peat								
3. Light surface Peat, Wood of Allen, ...	0·187	0·725	0·206	0·302	0·171	0·179	0·721	0·760
4. Black compact Peat, do.	0·393	1·524	0·286	0·419	0·197	0·075	0·571	0·565
5. Surface Peat, from Ticknevin, ...	0·210	0·814	0·196	0·287	0·147	0·170	1·262	0·617
5. Do., distilled with the retort heated to redness, ...	0·195	0·756	0·208	0·305	0·161	0·196	0·816	0·493
6. Surface Peat, from Shannon, ...	0·404	1·567	0·205	0·299	0·132	0·181	0·829	0·680
7. Dense Peat, do, ...	0·181	0·702	0·161	0·236	0·119	0·112	0·647	0·266
Average, ...	0·268	1·037	0·191	0·280	0·146	0·134	0·790	0·550

The second series of experiments or those made by burning the turf in a blast of air, that is, under the same conditions, except as to quantity, in which Mr. Reece proposed to effect his object, was made with the same peats as those named in the preceding tables; but as the object sought was merely to ascertain whether the action of the blast affected the nature of the process of distillation, or the amount of products, the three most dissimilar in quality of the varieties of peat subjected to distillation in close vessels were selected, and yielded the following results:—

Table showing the proportion of Water, Ash, and Gas, obtained by the distillation of Peat in a blast of air.

Character of Turf, and locality from whence obtained.	Water.	Tar.	Ash.	Gas.
Light surface Peat from Wood of Allen,	31·678	2·510	2·493	63·319
Dense Peat, Do., ...	30·663	2·395	7·226	59·716
Dense Peat, from the River Shannon, ...	29·818	2·270	2·871	65·041

The gas being estimated by difference, represents only the proportion of the peat which would pass off in the gaseous condition. The real quantity of gas would be represented by those numbers, plus the quantity of air blown in.

The water and tar obtained in these experiments, when specially treated, yielded the following quantities of ammonia, acetic acid, naphtha, paraffine, and oils:—

Table representing the per-centage of Ammonia, Acetic Acid, Naphtha, Paraffine, and Oils, obtained by the distillation of Peat in a blast of air.

	Ammonia.	Acetic Acid	Naphtha.	Paraffine.	Oils.
Light surface Peat, Wood of Allen,	0·322	0·179	0·158	0·169	1·220
Dense Peat, Do, ...	0·344	0·268	0·156	0·086	0·946
Dense Peat, from the River Shannon	0·194	0·174	0·106	0·119	1·012
Average,	0·287	0·207	0·140	0·125	1·059

It will now be important to summarise these results, and to contrast them with each other, and with the statements in the prospectus of the company. The turfs examined contained:

	Average.	Maximum.	Minimum.
Moisture	19·71	29·56	16·39
Ashes	3·43	7·90	1·99

The products of distillation, in close vessels, of these peats, collected as 1, charcoal; 2, tar; 3, watery liquids; 4, gases, may be thus summarised:

	Average.	Maximum.	Minimum.
Charcoal	29·222	39·132	18·973
Tar	2·787	4·417	1·462
Watery products ...	31·378	38·127	21·819
Gases	36·616	57·746	25·018

The tar and water, on being separately examined, yielded:

		Average.	Maximum.	Minimum.
Ammonia, ... ..	...	0.268	0.404	0.181
Or as				
Sulphate of ammonia	...	1.037	1.567	0.702
Acetic acid, ... ..	...	0.191	0.286	0.076
Or as				
Acetate of lime ... ..	...	0.280	0.419	0.111
Naphtha ... ..	...	0.146	0.197	0.092
Volatile oils ... ..	...	0.790	1.262	0.571
Fixed oils ... ..	...	0.550	0.760	0.266
Paraffine ... ..	...	0.134	0.196	0.024

These numbers show that the amount of products which can be obtained from a given weight of turf vary within very wide limits, which depend upon the kind of turf, its comparative state of dryness, but especially the temperature at which the distillation is effected.

The results of the distillations effected by aid of a blast of air, summarised in the same manner, would be as follows:

		Average.	Maximum.	Minimum.
Watery products	...	20.714	32.678	29.818
Tar ... ..	..	2.392	2.510	2.270
Gases ... ..	...	62.392	65.041	59.716
Ashes ... ..	...	4.197	7.226	2.493

The watery products and tar yielded:

		Average.	Maximum.	Minimum.
Ammonia, ... ..	...	0.287	0.344	0.194
Or as				
Sulphate of ammonia	...	1.110	1.330	0.745
Acetic acid, ... ..	...	0.207	0.268	0.174
Or as				
Acetate of lime ... ..	...	0.305	0.393	0.256
Naphtha ... ..	...	0.140	0.158	0.106
Volatile and fixed oils	...	1.059	1.220	0.946
Paraffine ... ..	...	0.125	0.169	0.086

The average results of both series of experiments, that is, of distillation in close vessels, and in a blast of air, may be thus contrasted:

		Average produce from close distillation.	Average produce from distillation in blast air.
Ammonia ... ..	...	0.268	0.287
Or as			
Sulphate of ammonia	...	1.037	1.110
Acetic acid ... ..	...	0.191	0.207
Or as			
Acetate of lime ... ..	...	0.280	0.305
Naphtha ... ..	...	0.146	0.140
Oils ... ..	...	1.340	1.059
Paraffine ... ..	...	0.134	0.125

From the preceding table we deduce the very important result, that the difference between the average quantities of products obtained by both methods is not greater than that which would be found between those of different peats distilled in the same way, and that consequently there can be no important difference between close distillation and that effected in a blast of air.

Previous to the formation of the Irish Peat Company, Mr. Reece made a number of experimental trials at Newtown Crommelin, in the Co. Antrim, in a small furnace capable of distilling about two tons of peat in 24 hours. These experiments were conducted under the superintendence of Dr. Hodges, Professor of Agriculture in the Queen's College, Belfast; and being made under what we might call, in some respects, manufacturing conditions, it will be important to contrast the results with those obtained in the laboratory. The first columns of the following table contain the mean results of all the experiments conducted by the last process in the laboratory of the Museum of Irish Industry; the second contains the results obtained by Dr. Hodges, who did not, however, prepare the oils and paraffine from the tar; and I shall add, in the third column, the quantities assumed as the basis of the company's calculations in their prospectus, and apparently the results of Mr. Reece's previous experiments:

	Laboratory Experiments.		Professor Hodges' Experiments.		Statement in Company's Prospectus.	
	Per ton.	Per cent.	Per ton.	Per cent.	Per ton.	Per cent.
Sulphate of ammonia	24 $\frac{3}{8}$ lbs.	1.110	22 $\frac{3}{4}$ lbs.	1.000	22 $\frac{3}{4}$ lbs.	1.000
Acetic acid (real hydrated)	4 $\frac{3}{4}$ „	0.207	7 $\frac{1}{4}$ „	0.328	—	—
Or as						
Acetate of lime	6 $\frac{1}{2}$ „	0.305	—	— nearly	15 $\frac{1}{8}$ „	0.700
Wood naphtha	50 $\frac{1}{2}$ oz.	0.140	83 $\frac{1}{4}$ oz.	0.232	66.3 oz.	0.185
Tar	53 $\frac{3}{4}$ lbs.	2.390	99 $\frac{1}{2}$ lbs.	4.440	—	—
Products {Paraffine	2 $\frac{1}{2}$ „	0.125	—	—	3 lbs.	0.104
of the tar {Oils	nearly 2 $\frac{3}{4}$ gals.	0.159	—	—	2 $\frac{1}{2}$ gals.	0.071

The turf operated upon in the experiment superintended by Dr. Hodges was a black unctuous kind, common in the glens of Antrim, a cubic yard of which weighed about 5 $\frac{1}{2}$ to 6 $\frac{1}{2}$ cwt. This peat, which was quite distinct from any of those above mentioned, yielded in 100 parts:

Water and volatile matter,	...	70.15
Charcoal,	...	24.50
Ashes,	...	5.35
		100.

If we take into account the difference between the peats operated upon, the different modes of distillation, and the different temperatures at which the distillation was effected, we may consider the results obtained in the Museum of Irish Industry, and by Dr. Hodges, as substantially the same as the statements put forward in the prospectus of the Company.

Soon after the formation of the Irish Peat Company a site was selected upon which to erect a works. The site selected was on the margin of a large tract of bog, situate about 5 miles to the northward of the town of Athy, in the County of Kildare, and within a few yards of the Carlow branch of the Great Southern and Western Railway. A small works was first erected, chiefly with a view to devise the best mechanical means of effecting the distillation, and a perfect process of purifying the different products. Considerably more difficulty was encountered in effecting these objects than was at first anticipated. Many of the difficulties which beset

the employment of the waste gases as the sole source of heat were however overcome, but little progress was made in the purification of the products. Nevertheless, such was the faith of the projectors of the scheme, and of the directors of the Company in its ultimate success, that it was decided to erect a large and permanent works, although the problem was very far from having been solved by the trials made with the small temporary works. Under such circumstances, therefore, as was to be anticipated, the erection of the new works occupied a very considerable time. As many things had to be invented, and even where the individual parts were not new, their mode of combination was, the labour of months might be said to have occupied years. The factory may now be considered to be completed, and it is our purpose, therefore, to describe the arrangements which have been adopted to effect the object in view, and the modifications which have gradually developed themselves in the original plans of the Company.

As it would be impossible to do justice to so important a subject within the narrow limits of one article, we purpose dividing the subject into two parts, to the first of which we shall devote the remainder of this article. As the basis of the whole manufacture is the combustion of the peat, and the condensation of the tarry and aqueous products, and the economization of the gaseous products, we shall treat the latter portion of the subject first, leaving the account of what has been done in the purification of the products to a subsequent article.

The arrangement for the combustion of the peat consists of four furnaces, constructed exactly like ordinary high furnaces, and, like them, without any grating of firebars, such as was proposed in the original patent of Mr. Reece, and having each three tuyeres for conveying the blast into the furnace. Each of these furnaces is 32 feet 7 inches high from the ground to the top of the hopper, the hearth is 3 feet 2 inches deep, 3 feet wide, and 18 inches to the top of dam plate, the tympanum is 13 inches high, and has 2 inches of water space; the boshes is 7 feet 6 inches high, from the bottom of crucible, and 12 feet wide at belly; the cone or body is 16 feet high, and 6 feet wide at tunnel head. The base of each furnace externally is square as high as the belly, and the whole of the cone or body is covered with boiler plate, firmly riveted. This mode of covering the brickwork is necessary in order to prevent leakage of the products of distillation, but there is no doubt that its general adoption in all iron furnaces would bind the furnace together far better than the present system of iron bars. We understand that many furnaces are, indeed, thus bound in England.

The top of the furnace is completely closed by a conical valve, 3 feet in diameter, surmounted by a charging hopper provided with two tight-fitting lids. This hopper is 5 feet high from the valve opening to the lid, and 8 feet in diameter at top. Two pipes, 12 inches in diameter, convey the products of distillation into a hydraulic main, 3 feet in diameter, from whence the condensed tar and liquid flow into a tank, while the gas is made to pass through two double rows of upright condenser pipes, 12 inches in diameter, and 25 feet high, including the two series of rectangular boxes, upon which they are fixed, and which we shall describe presently.

During the passage of the gas through these pipes an additional quantity of tar and aqueous products are condensed, and fall into the rectangular boxes, which are all placed in connection by connection-pipes, and from whence they continually flow into the tank before mentioned.

From the condensers the gas passes through 8 scrubbers, each 20 feet high, and placed in four rows. Each scrubber has three layers of stones resting upon gratings, and is provided with a mill and tumbler, by which a dense rain is made to fall through the scrubber, so as to wash the gas and remove as much of the tar and other condensable products, especially naphtha, as possible. From the scrubbers the gas passes into a kind of drum or main, called the trunk, 25 feet 3 inches long, and 3 feet 8 inches in diameter, which serves as a valve, and whence the gas is conducted to the several fire-beds by means of iron pipes, or brick sewers well lined with cement.

Plates I. and II. represent the plan, elevation, and section of these arrangements on a scale of one inch to 5 feet. The letters on both plates represent the same objects. A is one of the furnaces, shewn in elevation, (plate I.) B is the hopper, the covers of which, also marked B, are shewn in fig. 1, plate II, with the two lids H, provided with hinges and flanges which fit into grooves. Fig 2, plate II, represents a section of the furnace along the line *x*, plate I; *a* represents the arrangement of the tuyeres with their nozzles, showing the water spaces and the plug valves for allowing the tuyere openings to be kept clear, B is the hopper, and *c* the conical valve with its grooved rim, into which fits a circular flange surrounding the valve opening. The valve *b* may be raised or lowered by means of the rod and chain *c* attached to the lever *d*, having a sort of box on one end, into which fits a number of small cast iron plates forming the counterpoise *e*.

C, fig. 1, plate II, represents the platform on the top of the four furnaces, formed of planks of wood laid in the same plane as the covers of the hoppers. The turf is elevated to this platform in iron waggons, each of 30 cubic feet capacity, by means of a water-lift, consisting of a floor upon which four waggons fit, supported by a frame work or cage, with friction pulleys at the angles, which work against four upright pillars of wood, which support a frame work at top, having a drum and brake. The flooring or cage is attached to a chain which passes over the abovementioned drum, and is counterpoised by a wrought iron cistern, 5 feet square, and 2 feet 6 inches deep, provided with a valve in the bottom with an externally projecting spindle.

The peat is brought from the bog in flat bottom boats by means of a canal, which terminates in a kind of basin, having a quay a few yards wide at the foot of the lift. Upon this quay the waggons are filled with turf, which are then rolled in upon the floor of the cage, which is let down to the level of the quay. In this position of the cage the counterpoise or iron cistern is at top; into this water is allowed to flow from the tank I, (fig 1, plate II,) which is supplied by the feed pipe, J, in connection with a large pump worked by a steam engine, which also works all the other pumps connected with the other arrangements of the works. When the cistern is full it more than counterbalances the cage and waggons, and

accordingly, on letting go the brake the cistern descends, and by means of the chain passing over the drum, drags up the cage and waggons to the level of the platform, G. When the cistern full of water reaches the ground, the projecting pin strikes against the ground, by which the valve is lifted and the water allowed to flow out.

The waggons full of turf thus lifted up to the level of the platform are rolled along tram ways at each side of the hoppers, the end of one of which is marked N, to the furnace into which the turf is to be put. At each side of the cover of each hopper is a turning table M; the waggon being brought upon this table, it is made to describe a quarter revolution, so as to bring the end of the waggon, which is provided with a hinge and latch, over one of the hopper lids H, which is then lifted, and the contents of the waggon discharged into the hopper, by lifting the waggon which is attached by only one of its ends to a truck. Three waggons full of turf or 90 cubic feet constitute a charge, that is to say, fill the hopper.

During the operation of filling the hopper, the conical valve *b* is, of course, closed, as it is represented in fig 2, plate II, and no gas or other products of distillation can, escape through the hopper. As soon, however, as the hopper is filled, the lids H, fig 1, are closed, the groove into which the lid flange fits being first partially filled with a mixture of turf dust and some of the blue clay marl underlying the peat bog, mixed up into a paste with water. This paste forms an excellent lute around the lid, which is kept tight by a latch. The valve *b* (fig 2, plate II.) may now be lowered by means of the lever *a*, which, while the valve is up, has its end bearing the counterpoise *c* hooked to the platform by means of the small hole which is seen near the counterpoise; in this way the valve is kept pressed against the flange around the valve opening. As soon as the valve is let down, the turf falls into the body of the furnace, whereupon it is again lifted, and the hopper may be recharged.

The only loss of gas sustained by the arrangement is simply the full of the hopper each time the furnace receives a charge. When light peat is burned each charge weighs no more than 7 cwt., so that it would require about 143 charges to burn 50 tons, and 286 to burn 100 tons, the latter being the quantity which the furnaces were calculated to burn in the twenty-four hours. Supposing 100 cubic feet of gas to be lost by each charge, the maximum loss of gas and products in twenty-four hours would only be 28,600 cubic feet. As the average good brown turf would weigh, per charge of 90 cubic feet, about a half ton, it would only take 200 charges in the 24 hours. Supposing the furnace to consume 100 tons in that time, the loss of gas from this source would only amount to 20,000 cubic feet, a quantity compared to the total quantity produced very insignificant indeed.

The mode of closing down blast furnaces just described is perhaps the most perfect ever adopted, and is equally applicable to the ordinary charcoal, or coke, or coal high furnaces as to the peat furnaces just described. The fuel, ore, and flux, may be introduced into such a hopper with the greatest facility, and the whole of the gases thus economised, and applied to the puddling, refining, &c., of iron. In this point of view alone, and

without reference to the special application of which we are treating, this method is of paramount importance at the present moment to the iron trade of the whole world.

As this method is but the last of a number of successive improvements which have been effected in different countries and by different persons, it may not be uninteresting to our readers to trace the progress of these improvements.

The first mode of economising the waste gases of furnaces was that of Faber du Faur, who placed a ring of flues all round the inside of the furnace, at about one-third of the height of the body from the top. These flues passed upwards through the brick work, and the hot gases were then conducted away by a descending pipe to the points where they were required. This method had the disadvantage of drawing off not merely the waste gases, but even the actual flame, so that a large portion of the heat was wasted; and when used in heating the blast, or for similar purposes, the heat produced was so excessive that the apparatus was often burned through. Mr. James Palmer Budd, of Ystal-y-Fera, in Wales, to whom the honour belongs of having first attempted to utilize the waste gases in Great Britain, modified the method of Du Faur, by tapping the gases at a part only three feet below the throat of the furnace. As the same quantity of the gases would not enter flues at that point as lower down, and as they would get mixed with air, Mr. Budd, by making an upright flue, 25 feet higher than the platforms of his furnaces, and provided at top with a kind of damper, was enabled to suck, as it were, any quantity of the hot gases, and make them pass under boilers and heat the blast, &c., before finally passing off through a high chimney. It is unnecessary to remark, that in Mr. Budd's arrangement for heating the hot blast, the gases were not burned, except in the case of the steam boilers, under which we believe the gas was burned; it was only the high temperature at which they issued from the furnace that was taken advantage of.

The next modification worthy of notice is the mode in use at the Dundyvan Works, in Scotland. The furnace is 42 feet high, and is 12 feet in diameter at 8 feet from the top; from this point it narrows to 8 feet at the filling place. Just below the point at which the narrowing commences is a ring of 8 flues, 4 feet high and 18 inches in diameter, all of which open into an annular flue surrounding the top of the furnace, from near the top of which the gas is conducted away. A similar plan is adopted at Pontypool, the width of the furnace in this case, below the ring of flues, being 13 feet, and narrowing to 9 feet 6 inches.

Another plan, and one indeed adopted at a very early period, was to introduce a cylinder somewhat smaller in diameter than the throat of the furnace, and open at both ends, into it, and having a projecting flange on its upper end, which rests on the top of the furnace. There was formed an annular chamber, in which the gas collected, and into which the flues or ports opened. By keeping the central cylinder full of fuel and ore, a certain resistance was offered to the passage of the gas, which accordingly passed off by the flues in the inclosed space. This plan, which was first employed on the Continent, has also been tried in Great Britain, and

among other places we believe at Dundyvan, in connection with the system of flues just described.

In all the preceding cases only a portion of the gases was economised, whilst the rest escaped into the air. To utilize the whole it would obviously be necessary to completely close the furnace, and accordingly one of the earliest attempts was that made at the great iron works of Le Creusot, in France. This method, which is, we believe, still used in seven furnaces there, is represented in fig. 1. C is a conical iron cylinder, which

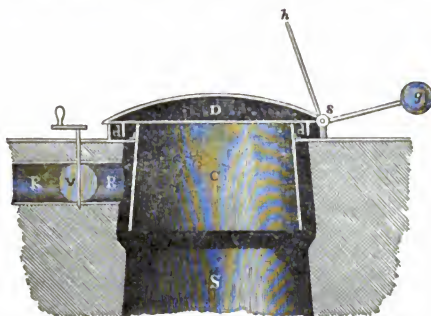


Fig. 1.

has exactly the same inclination as the walls of the furnace, S, and therefore as it were a continuation of it. Just below the cylinder, C, the wall of the furnace is beveled off for a short distance, and then goes up parallel with the cylinder, C, forming an annular space exactly like that described above. D is a double cover, hinged on at s, and which may be lifted by means of the lever, h, with the counterpoise, g. This cover has a flange all round it, seen at d d, which fits into an annular box or groove, in which water or sand may be put to form a tight joint. The gas, as it ascends, passes into the annular space around C, from which it is carried off by the gas duct, R, having a throttle valve, v, for regulating its supply as may be required. Independent of the fact that by this plan the furnace can be completely closed down, the cylinder, C, being in a line with the walls of the body of the furnace, S, allows the charge to descend with the same regularity as if the furnace were open; whilst with the cylinder before described, the materials went too much towards the centre, which is a great evil, as it is of great importance to have a column of blast in the centre of the furnace, while the ore and flux should lie towards the sides.

This last object is still more perfectly attained in the next modification of importance with which we are acquainted. This plan, which is represented in fig. 2, was, we believe, first adopted by Mr. Levick, of the Cwm

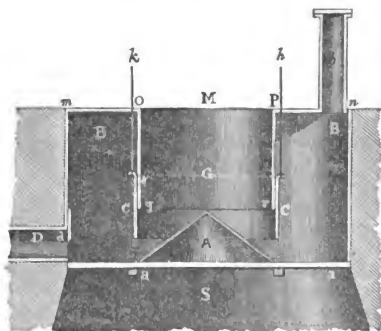


Fig. 2.

Celyn Works, near Abergavenny, in Wales, and a model of it was exhibited at the Great Exhibition of 1851, in connection, if we recollect aright, with a model of a blast furnace contributed by Mr. John James, of Blaenau Works, which belong to Messrs. Crutwell, Allies, & Co., who are also the proprietors of the Cwm Celyn Works. The upper part of the body of the furnace, for a distance of about 5 feet below the mouth, *M*, is cylindrical. At the junction of this cylindrical part with the conical body, *S*, is a double cross, *a*, formed of iron bars let into the masonry; upon the centre of this cross is placed the cast iron cone, *A*, the apex of which is in the axis of the furnace, and whose base is about 2 feet all around from the wall of the furnace. Upon the same cross bars rests the hollow annular cast iron cylinder, *B*, open at its lower end, which diminishes the mouth of the furnace, *m n*, to the space, *o p*. The lower edge, *q r*, of the inner wall of the cylinder, *B*, is about $1\frac{1}{2}$ feet from the base of the cone, *A*, so that an opening of 18 inches wide exists all around the cone into the body of the furnace. This opening can be closed by means of the cylinder, *C*, open at both ends, which fits on the inner wall of the cylinder, *B*, like the tubes of a telescope, and may be drawn up or let down by the rods, *k h*. When the cylinder, *C*, is let down upon the cone, *A*, the furnace is completely closed, and the whole of the gas will pass off by the duct, *D*. If in this case the internal cylindrical space over the cone is filled with fuel, ore, and flux, and the cylinder, *C*, be lifted to the level of the dotted line, *G*, the whole charge will fall into the furnace, and under the best conditions, for the central column of blast will remain undisturbed. The duct, *D*, can be closed, in case it may require closing, by the damper, *d*; in such case, the pipe, *b*, which is closed by a cap, admits of the escape of the gases. By this plan all the gases could be economised, except merely what passed off while the charge was being allowed to fall into the furnace.

The next important improvement with which we are acquainted was that effected at the Ebbw Vale Works, near Abergavenny, and is manifestly an improvement upon the plan followed at the neighbouring Cwm Celyn Works just described. This method will be at once understood by a reference to fig. 3. In this case a hopper, in the shape of an inverted truncated cone, B, is fitted into the mouth of the furnace, corresponding to the internal cylinder in fig. 2, and by making the cone B movable, the cylinder, C, in fig. 2, is dispensed with. When the cone is drawn up by the chain and lever shown in the figure, the furnace is perfectly closed, and the whole gas is forced to pass off by the pipe, C.

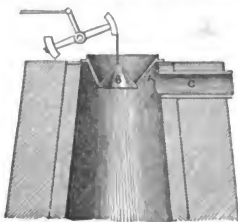


Fig. 3.

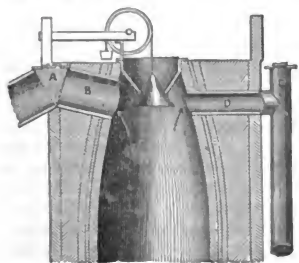


Fig. 4.

Fig. 4 represents a modification of this plan adopted by Mr. Blackwall, either in Derbyshire or South Staffordshire, in which, however, there is no feature of novelty. A is a vent closed with a cap upon the main gas duct B; D is a smaller duct leading to the conducting pipe C, which is also provided with a cap to facilitate cleaning.

There is a great difference of opinion relative to the economy of closing down furnaces; some assert that it is not so great as was anti-

ipated, whilst others say that only white iron can be made with closed furnaces. Into this question we shall not now enter, but we may as well say that the plan shown in fig. 3, and a model of which was exhibited at the Great Exhibition of London, already was in such successful operation in the previous year (1850) at the Ebbw Vale Company's works, that out of 25 boilers required to work 5 blowing machines, which supplied air to 11 high furnaces, 19 were fired with gas alone.

It will no doubt be interesting to mention here the nature of the gas generators used at Ilseburg, in the Harz, for iron puddling, to which allusion has already been made. These generators are made either with a round or square section, both forms having been found equally well adapted for the object required, and work by the ordinary draught of air, no blast being used. There is first an ash-pit, 2 feet deep and 2 feet 6 inches square. Over this is placed a grating of fire-bars, resting upon two iron bars 3 inches square; above the grating is the hearth, 9 inches high. The ash-pit and hearth would, in fact, constitute, if the fire-bars were removed

a hearth similar to that of an iron furnace. Above the hearth is formed a small boshes, 1 foot high, with its greatest diameter 3 feet 6 inches, which again diminishes at the top of the cone or body to 2 feet. The height of the body to the gas duct is only 3 feet 6 inches, and the gas duct is 18 inches high and 18 inches wide, so that the whole height of the cone is only between 5 and 6 feet.

The filling of this small high furnace takes place by means of an iron cylindrical hopper placed on top, 7 feet 9 inches high, and 1 foot 6 inches in diameter. This hopper is closed by means of a lid, and has a sliding damper or valve 3 feet below the top. When this valve is closed the lid on the top may be opened and the fuel introduced, so as to fill the three feet of the cylinder or hopper above the valve; the latter is then drawn out like a damper and the charge allowed to fall into the furnace. In a subsequent article I will return to this subject of gas puddling, and then have an opportunity of giving some details respecting the cost of fuel, quantity of iron puddled, and other matters which would now occupy too much space.

The great disadvantage attending all the methods which we have described, with the exception of that used at Ilseburg, is, that every time that a charge is introduced into the furnace, there is a momentary diminution of the quantity of gas passing into the respective flame beds, owing to the top of the furnace being opened. This is not of so much consequence in iron furnaces worked with coke, where the charges are larger and are not, comparatively speaking, very frequent; but it is very different in the case of a peat works like that which we are describing, for peat is so bulky, that even with a large hopper each charge is very small, and then the waste gases should be so fully economized that even the momentary diminution of the regular flow of gas would produce serious inconvenience. Hence the necessity, not alone of closing the furnace itself, but also of closing the hopper in the manner described. In this alone it differs from the system at Ebbw Vale, upon which it is evidently an improvement, but though slight yet in our opinion an important one.

We shall now return to the description of the arrangement of the Peat Works, which we broke off in order to shew what had been done in other places towards effecting the shutting down of iron furnaces.

The air blown in by the tuyeres *a a*, comes in contact with incandescent charcoal on the hearth, a combination ensues, the oxygen of the former, in presence of an excess of carbon, is resolved into carbonic oxide, which, in an intensely heated state, passes up with four times its volume of similarly heated nitrogen, the residue of the air after the abstraction of the oxygen, through the body of the furnace, until it meets with the fresh charge of peat, which it heats sufficiently to allow of complete distillation taking place. The results of this distillation are: water containing, as already several times remarked, ammonia, naphtha, &c.; tar, and gas, consisting chiefly of carbo-hydrogen. From the high heat of the ascending gases, the tar and aqueous products are produced in the state of vapour, and are carried along with the gas, and conveyed away by the outlet pipes *C*, of which there are two to each furnace; these pipes issue from near the top of the furnace, and consist of a short ascending branch and a long descending one,

the angle where they meet being provided with a hand-hole for cleaning out, which can be secured by a dog and screw. The long arm enters the hydraulic main D, shown in section in plate I., which is kept half full of liquid, below the surface of which each outlet pipe dips, and thus isolates each furnace, in the same manner that the outlet pipes from gas retorts dip in the corresponding hydraulic main. The hydraulic main consists, first, of the great main running along the front of the four furnaces, and marked D; secondly, of a cross piece, E, which connects it with another short one, F, (shown in section in plate I.) The long main D, and the short one F, are closed at the ends with plates of iron, which can be removed whenever the main requires to be cleaned out. Overflow pipes screwed to those plates serve to convey away all the tar and liquid which come into the main and rise above the proper level in it; the tar and liquid flow into a large tank not marked upon the plan, but whose place is indicated by the letter Y in plate II. fig. 1.

Four ascending pipes convey the gas and non-condensed products from the main into the condensers; each of these pipes is provided with a valve, W. As was already stated, there are two distinct series of condensers—each series consisting of eighteen rectangular boxes, shown in section at U, fig. 3, plate II. Upon the top of each of these boxes are placed four upright pipes, shown in plan and fig. 1, plate II. at O. Where these boxes are placed, as represented in the figures, the pipes of each series constitute two rows. The adjoining pipes in each row, belonging to different boxes, are connected by the breeches piece, i, which has two openings in the top, closed by caps and dogs and screws, P. The gas passing through the valve W, is thus enabled to pass up one pipe in a row, down the next into the first rectangular box, thence up the next, and by means of the breeches pipe into the next condenser pipe and box, and so on.

The rectangular boxes are of peculiar construction, they are divided into two compartments by the diaphragm *f*, (fig. 3, plate II.) which does not, however, go to the bottom, and thus leaves a means of communication between the two compartments. The four pipes open into one compartment, while the other compartment has a sort of semi-circular opening, U, in one of its sides. By keeping these boxes half full of water, that is nearly to the level of the opening U, the side chamber is isolated, and the gas passing into it cannot, unless the pressure be so great as to drive out all the water through V, escape except through the series of pipes, while the water and tar continually being condensed in the pipes fall into the boxes, and the latter gradually makes its way under the diaphragm into the outer chamber, from which it is removed from time to time by the opening U. All the boxes in a row are put in connection by means of short connection pipes near their bottoms, so as to maintain the same level in all. The liquid products continually coming into those boxes would very soon fill them above the proper level, unless some means were provided for carrying the excess away. This is done by making the connection between the end box with the tank Y by means of a syphon pipe, the bend of which corresponds with the proper level of liquid in the condenser boxes.

In order that the condenser pipes should never get too hot, a pipe, K, in connection with the cistern I, is carried along the top between the

two rows of condensers, to each set of which it sends out an arm L, pierced with small holes, which allows a fine rain to fall on the tops of the pipes and trickle down the sides, and thus cool them effectually.

Notwithstanding the enormous cooling surface afforded by the double line of condensers, a certain quantity of the tar and ammonia, and the greater part of the naphtha, still remains uncondensed, or are carried forward mechanically by the force of the blast. It has hence been found necessary to pass the gas through the scrubbers Q, of which there are eight, placed in four rows, corresponding to the four rows of condenser pipes. Each scrubber consists of a wrought iron cylinder 4 feet 6 inches in diameter, and 20 feet high, closed at both ends, and having three gratings, upon each of which is placed a layer of stones, shown at *j*, (fig. 4, plate II.) The gas enters at *m*, and passes up through the layers of stones, while at the same time the mill, *k*, supplied with water from an inch pipe supplied from the pipe K, or by the tumbler *l*, produces a dense rain by its revolution, which percolates through the stones, and thus completely washes the gas in its passage upwards. The water carrying with it the tar held in mechanical suspension by the gas, and holding in solution a large portion of the naphtha produced from the turf, after passing through the lower layer of stones, flows off, by means of a pipe, into one of a series of tanks, not shown on the plan, but whose place is marked Z. The gas passes from the tops of the first scrubbers, by means of pipes, into the bottoms of the second row of scrubbers, where it is still further washed, and thence passes by the pipes, R, into a sort of gas-holder, or rather valve, S, consisting of a wrought iron cylinder 25 feet 3 inches long, and 3 feet 8 inches in diameter, and kept full of water to the level of the dotted line at S in plate I. By means of the valves, W, in the conducting pipes from the main, F, and the dip of the pipe, R, into the water of the gas-holder or trunk, S, each row of condensers and each pair of scrubbers may be isolated, and the gas shut off from them whenever they may require cleaning.

As the whole of the water which is made to fall through the scrubbers must be distilled in order to obtain the ammonia and naphtha which it washes out of the gas, it is sometimes found desirable to make the same water serve two or three times for washing the gas. This is effected by placing the barrels, T T, on the tops of the scrubbers, Q Q, and pumping into them from time to time a portion of the liquor from the tanks, Z, (fig. 1, plate II.,) into which flows, as we have just observed, the water from the bottom of the scrubbers. Each barrel, T, supplies this liquor to four scrubbers, by means of four inch pipes, seen on the plan, fig. 1, plate II. By this means fresh water, or that which has served before, may be used for washing the gas, or both may be used together. The tar of the peat being solid, the layers of stones are sometimes liable to get clogged with it; to prevent this occurring, each set of scrubbers has such a disposition of pipes that steam may be admitted into the scrubbers so as to melt the tar. This operation is usually repeated once a day.

From the gas main, S, the gas, now freed from nearly all condensable products, passes off by the main gas duct, X, from which, by means of

branches, it is conducted to the several flame beds, where it is burned. As the arrangements for the combustion of the gases are intimately connected with the dispositions for the distillation of the tar, and the subsequent processes of purification, we shall have an opportunity of explaining them in full in our next article.

Having thus described the mode of economising the waste gases, the next question to be considered is their composition, and the quantity of them which can be obtained from a given weight of peat. This is an important part of the subject, and would require much more space to discuss than we have at our disposal in the present number, and we must accordingly postpone entering upon it until the next number. This course will be attended with some advantage, because, as the nature and quantity of the gases produced are in close relation with the production of the other products of distillation, they can be better studied together than separately.

ART II.—*On Jennings's Patented Process for Improving the quality of Flax Fibre.*

THE usual flax patents brought of late before the public, have been of that class which require that the operations for freeing the fibre from the foreign matters enveloping it, should begin with the flax straw, the manufacturer being, however, compelled to carry on those operations near the place of its growth, as carriage is a very important item of expense in an article not worth more in this country, generally, than from £3 to £4 per ton, and often less.

Many of these processes yield a very superior fibre, but immense quantities of a low quality fibre, indeed, we might say the chief part of our supply of flax, comes from countries where these improved processes for the preparation of the fibre are not likely to come into general operation for a long time. Any process, then, which would enable us to improve the quality of these low fibres after they come into the market, would, undoubtedly, be of great importance to the linen trade. Now, the patent plan of Mr. Francis M. Jennings, of Cork, is applicable to the fibre as it comes into the markets of Belfast, &c., or as it comes from Russia, Holland, Belgium, France, &c., so that any locality where flax mills are situated, or a fair supply of average water can be obtained, is a suitable place to commence working, and instead of having to operate upon a material worth about £4 per ton, we begin on what is worth from £30 to £100, or even more, per ton, and of which the supply is almost unlimited.

The process is very simple, and consists in throwing down upon the flax a small quantity of oil, say about half an ounce to the pound of flax; this is done by boiling the flax in an alkaline soap ley, washing with water, and then boiling it in water slightly acidulated with some acid, for which purpose acetic acid is, perhaps, the most suitable, from its exerting no injurious action upon vegetable fibre. The acid decomposes the soap, the fatty constituent of which is left in the fibre, or, perhaps, a mixture of

an acid soap and a small portion of free oil. These enter into and through every part of the fibre. After this treatment it is washed, and is then found to be soft and silky, its spinning quality being thereby much improved, and its value being very considerably increased; and, whilst the fibre is not weakened, this process gives to it what is known in the trade as "nature." The improvement in quality may be estimated at from £8 to £10 per ton, and is capable of being made, with ease, probably double.

Flax submitted to this treatment sustains a slight loss, varying according to the extent to which the process is carried, but this is more than compensated for by the increased value communicated, to say nothing of the many other advantages obtained, among which we may mention:—1, greater facility of bleaching, owing to the cleansing which the fibre receives when in the state of flax, by every part being so easily and readily accessible to the soapy solution; 2, less loss of weight in bleaching, the after processes of the bleacher in beetling, &c. being at the same time much diminished; 3, less loss in preparing the thread or warp for the weaver. But even setting aside these latter advantages, which are, nevertheless, of the greatest importance to those who carry on the different operations of weaving and bleaching, the improvement in value effected is sufficient to recommend the process to the notice of flax spinners. The following letter from the Messrs. Marshall, the great flax spinners of Leeds, to the Flax Improvement Society of Ireland, gives some interesting details relative to this increase of value.

LEEDS, Jan. 12, 1854.

"DEAR SIR,—We have sent off to your address a small package of samples of flax which Mr. Jennings asked us to send, in order that the Belfast spinners might see the results of his process on different qualities of flax, in the hope that some of them may take out licences, which we should be willing to grant on moderate terms. The expense of steeping-vats, &c., would be small. The improvement of quality is considerable, and the strength is not apparently reduced.

"I remain yours truly,

"James Mac Adam, jun., Esq."

"ARTHUR MARSHALL.

"Samples of flax fibre re-steeped on Mr. Jennings's patent plan. Five stricks of each, re steeped and not re-steeped, viz. :—

			Loss in steeping, lbs. per cwt.
Dutch.— $\frac{1}{V}$.	Quality before steeping,	}	... 9.9 lbs.
" $\frac{1}{IV}$.	Do. after do.		
Dutch.— $\frac{2}{V}$.	Quality before steeping,	}	... 9.5 lbs.
" $\frac{2}{IV}$.	Do. after do.		
Irish.— $\frac{2}{V}$.	Quality before steeping,	}	... 1.3 lbs.
" $\frac{2}{IV}$.	Do. after do.		
Irish.—IX.	Quality before steeping,	}	... 1.3 lbs.
" VII.	Do. after do.		

"Of the $\frac{1}{V}$ and $\frac{2}{V}$ Dutch we have steeped some quantity, and find the value improved £11 to £12 per ton. The $\frac{2}{V}$ Irish is improved £11 per ton, and the

IX. Irish £11 per ton. This increased value is after we have deducted the loss in re-steeping, but not including the cost of steeping, which is about 4s. per cwt. We have tested the strength of the flax, and find it as follows:—

		¹ V. Dutch.	² V. Irish.	IX. Irish.
Before Steeping,	...	273	236	192
After do.	...	271	236½	214

"The size of strick we test is twenty inches long, and a quarter ounce weight, and the above are the averages of four testings of each sort. We have also tested the yarn and thread made from the steeped material, and find the strength as good as the same sizes made from unsteeped flax."

This Firm now manufactures, according to this process, eleven tons per week, and are now adding to their arrangements, so as to manufacture double that quantity. They have been working it for over eighteen months, a time amply sufficient to test its practical value. To those flax manufacturers who export much thread, the process is specially important, as it would enable them to give to Dutch flax the well-known golden yellow Courtrai color. It is also worth mentioning, that without weakening its strength, Italian hemp put through this process after hackling, cannot be distinguished from almost the finest flax.

This process is patented through all the European flax producing states of the Continent, and is certainly well worth the attention of those in the trade.

ART. III.—On the Incrustation of Steam Boilers. By M. COUSTÉ.

In the *Annales des Mines* for the present year is an interesting paper by M. Cousté on the incrustations of steam boilers, and the methods for preventing their formation. He commences by pointing out that the prevention of incrustations, if realized, would produce a better preservation of the boilers, greater security against explosions, and considerable economy in fuel. For steam vessels it would be attended with an increase of available space for cargo, and the use of steam at high pressure.

He then presents the results of his investigations on the nature of deposits, and the circumstances connected with their formation, whether in boilers fed with salt or fresh water.

M. Cousté suggests four methods for preventing incrustations. The first is, in fact, the well-known method, which consists in extracting from the boiler, either at intermittent periods, or in a continuous manner, a certain quantity of water saturated with solid matter. He thinks this process imperfect for low-pressure engines, and quite useless for those at high-pressure. He proposes, however, to make some further improvements in it, as the greater number of marine steam engines work at low pressure, and may thus be in some measure benefitted.

The second of the methods described is called by M. Cousté, *alimentation nonhydraulique*, and requires the use of Hall's condensers. The principal objection to this method is the existence of a counter-pressure in the cylinder during too considerable a part of the stroke of the piston. By

calculation he finds that from about 25 to 30 per cent of force is lost in a low-pressure engine.

The third method consists in continually employing the same water for condensing the steam, and of course requires that this water must continually pass through a refrigerating process.

The fourth method, which belongs entirely to M. Cousté, consists in feeding the boiler with water heated to a very high temperature (at least 318 Fahrenheit) before being introduced into the boiler. This process has the effect of completely precipitating all the calcareous salts held in solution by the water.

The process requires a special heating apparatus, and a filter for separating the precipitate. The author remarks that the filtering which is necessary for engines at ordinary or low pressure, or for high-pressure engines working occasionally, might be dispensed with for marine high-pressure boilers, because the salts precipitated in the heater cannot again dissolve in the boiler, and consequently cannot crystallize, but will only form a muddy deposit instead of a fixed incrustation.

Finally, in comparing these different methods, M. Cousté thinks the last should be preferred for navigation, whether in salt or fresh water, and exclusively employed for locomotives; while the third more cumbrous method could be advantageously used for land engines under certain locally favourable conditions.

In order to accurately estimate the value of keeping the surfaces of boilers clean and free from incrustation, M. Cousté has mathematically investigated the loss of heat which takes place in causing the water in an incrustated boiler to arrive at a given temperature. He does this by comparing two boilers of the same shape and dimensions, placed under precisely the same conditions, except that one is covered with a calcareous incrustation all over its heated surface, while the other was free from deposit, and covered only with a thin coat of rust. They are supposed to be so managed as to produce equal quantities of steam in equal times. It follows that the heat of the fire under the incrustated boiler must be increased, hence a great loss of heat by the rarefied air and gas escaping through the chimney, and by the external radiation from the furnace. The first of these causes of loss is of course the most considerable, and it is it alone that the author has sought to estimate. This he does by the aid of some hypotheses, which enable him to establish his fundamental equations. From these he finally deduces the formula:

$$\frac{\Pi}{P} = \sqrt{1 + 2 M s}$$

where Π represents the loss of heat in the incrustated boiler due to the causes mentioned, P the loss in the non-incrustated boiler, s the thickness of the calcareous crust, and

$$M = \frac{K}{K'} \left(1 - \frac{b}{A} \right) \frac{1}{s + K \frac{\eta}{\gamma}}$$

in which K is the coefficient of conductivity of the boiler plates, K' of the calcareous crust, b the temperature of the water in the boilers, A the mean temperature of the heated surface of the non-incrusted boiler, e the thickness of the boiler plates, η the thickness of the coating of rust, and γ its coefficient of conductivity.

By the aid of these formulæ the loss of heat occasioned by incrustation in steam boilers covered with deposits not exceeding two tenths of an inch in thickness, is calculated to amount to 40 or 50 per cent.

That a considerable loss must be produced by boiler incrustations is thus proved, but it seems to be somewhat exaggerated. One result of these calculations seems, however, to be well established, namely, that the consumption of fuel increases rapidly with every increase in the thickness of incrustation.

M. Cousté makes highly interesting remarks on the nature and formation of the deposits. He distinguishes the deposits of marine boilers from those fed with fresh water. The former consist chiefly of sulphate of lime, and contain not a trace of carbonate of lime, while the latter are formed both of sulphate and carbonate in proportions varying with the localities.

He also distinguishes deposits which are merely muddy, or formed of matters suspended but not dissolved in the water, and which are formed of magnesia, oxide of iron, silica, &c., from the crystalline deposits which commence to form when, during the progress of evaporation, the water has arrived at a state of saturation with respect to the salts forming the deposits.

An important fact resulting from M. Cousté's observations is, that the state of saturation is brought about the sooner the water attains to a high temperature; that is to say, that the solubility of the sulphate and carbonate of lime diminishes in a rapid proportion as soon as the temperature rises above the boiling point. Between this and the freezing point, the former of these salts has for temperature of maximum solubility 95° Fahr., and at 212° its solubility is not much greater than at 32° . Hitherto the law of its solubility beyond the boiling point has not been examined; and M. Cousté is perhaps the first person who has shown that at temperatures somewhere about 320° , which corresponds to a steam pressure of four or five atmospheres, the solubility is almost destroyed. Upon this fact is founded the principal method proposed by M. Cousté for remedying the formation of incrustations,

He also explains by this circumstance the difficulties which have hitherto interfered with the use of high-pressure engines on board sea-going vessels.

ART. IV.—Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.

MINING, METALLURGY, ETC.

On the formation of Brass by Galvanic Agency.—Copper is more electro-negative than zinc, and separates more easily from its solutions than a metal less negative. If then in order to obtain a deposit of brass by galvanic means, we employ a solution containing the two component metals copper and zinc in the proportions in which they would form brass, there will only be produced by the action of the battery a deposit of real copper; the zinc, more difficult of reduction, remains in solution. What must be done then to obtain a simultaneous precipitate of the two metals in the proportions required, is either to retard the precipitation of the copper, or to accelerate that of the zinc. This may be effected by forming the bath with a great excess of zinc and very little copper.

Dr. Heeren gives the following proportions as having perfectly succeeded:—

There are to be taken of	Sulphate of Copper	...	1 part.
	Warm water	...	4 "
And then	Sulphate of zinc	..	8 "
	Warm water	...	16 "
	Cyanide of potassium	...	18 "
	Warm water	...	36 "

Each salt is dissolved in its prescribed quantity of water, and the solutions are then mixed; thereupon a precipitate is thrown down, which is either dissolved by agitation alone, or by the addition of a little cyanide of potassium; indeed it does not much matter if the solution be a little troubled. After the addition of 250 parts of distilled water, it is subjected to the action of two Bunsen elements charged with concentrated nitric acid mixed with one-tenth of oil of vitriol. The bath is to be heated to ebullition, and is introduced into a glass with a foot, in which the two electrodes are plunged. The object to be covered is suspended from the positive pole, whilst a plate of brass is attached to the negative pole. The two metallic pieces may be placed very near.

The deposit is rapidly formed if the bath be very hot; after a few minutes there is produced a layer of brass, the thickness of which augments rapidly.

Deposits of brass have been obtained in this way on copper, zinc, brass, and Britannia metal; these metals were previously well pickled. Iron may, probably, also be coated in this way; but cast iron is but ill adapted for this operation.—*Mittheilungen des Hannov. Gewerbevereins, through Bulletin de la Societ  d'Encouragement, No. 16, August, 1854.*

Briant's process of Electro-Gilding.—This process, verified by M. Jacoby, was made by him the object of a very favourable report to the Academy of Sciences of St. Petersburg. It consists in the substitution of the oxide of gold for the chloride of gold, and in the employment of a very feeble current engendered by an element of Daniell. The following are the details of the process:—

52 grammes* of gold are to be dissolved in nitro-muriatic acid, and the solution evaporated, in order to obtain the chloride of gold dry and with as little acid as possible. This chloride is then dissolved in 5 kilogrammes of hot water, and 100 grammes of well-sifted magnesia added and allowed to digest at a moderate temperature. The oxide of gold which is separated is found in combination with magnesia. This deposit, well washed, is then treated with water acidulated with nitric acid in the proportion of 375 grammes of acid to 5 kilogrammes of water; by its contact with this liquid the deposit cedes the magnesia, and is then simply hydrated oxide of gold, which is then to be washed on a filter until the washing water no longer colours litmus paper.

* 1 gramme = 15.433 grains

† 1 kilogramme = 2.202 lbs.

It is with the oxide of gold that M. Briant proposes to form his bath; he takes of

Yellow prussiate of potash	...	...	...	500 grammes
Caustic potash	...	...	...	120 "
Water	..	...	...	5 kilogrammes

and having dissolved them, the oxide of gold with its filter is added, and the whole boiled during 20 minutes. The oxide of gold dissolves, and there is formed at the same time a precipitate of sesqui-oxide of iron. It is allowed to cool, and is then filtered, by which a yellow liquid fit for use is obtained. The objects to be gilt should be well cleaned, and attached to the zinc pole of an element of Daniell, while the upper pole is connected with a platinum plate.

The gilding may be effected in a warm or cold solution; in the first case, the deposit forms more rapidly, but with less delicacy. In order to obtain a durable deposit, and analogous to fire gilding, several hours are required. When the liquid is exhausted, oxide of gold is again added, by which a fresh precipitation of oxide of iron is produced.

The gilding thus obtained perfectly admits of being burnished, and of undergoing all the operations employed to produce *mat* or dead gold.

M. Jacoby makes the following remarks:—One of the most difficult problems to solve in this branch of manufacture is the production of dead surfaces. Although we know the nature and manipulation of the process, it is only the Parisian workman who can perfectly succeed in this field; hence it is that these operations are always conducted by French workmen, as well in native establishments as in foreign establishments of some importance.

The production of dead gold is always accompanied by loss of metal, inasmuch as it necessitates a system of corrosion by chlorine. Nevertheless, Briant's process enables a matted surface to be obtained by galvanic agency, which is not inferior to the best of Paris, whilst it does not require any of those subsequent operations of the kind required by fire gilding. This deadening is spontaneously produced as soon as the coating of gold has acquired a certain thickness; it is more beautiful when the operation is carried on in the cold; by a very simple artifice a more or less reddish tint, on the one hand, or a whitish one, on the other, is produced: it is merely sufficient to dilute the bath by a greater or lesser quantity of water.

When the objects to be gilded are polished and brilliant, the electro-gilding will also be brilliant, and it requires a longer time and a thicker coating of gold to obtain a deadened surface. It is therefore important to communicate, in the first instance, to the objects a deadened surface by the process employed in fire gilding, or more economically, by covering them at once with a thin pellicle of copper by electric agency, which, as is well known, can be obtained with a beautiful matted service. But in both cases it is indispensable to eliminate the last traces of acid which might adhere to the objects; for this purpose they should be washed with water rendered alkaline and then with pure water.

An important point to be considered is the choice of the substance which is to be employed for protecting the points which should not be gilded, for it must be remembered that the gilding bath is alkaline; for this purpose plaster impregnated with an alcoholic solution of lac is recommended.

M. Jacoby mentions another process for obtaining a good electro-gilding: he dissolves a ducat of rolled gold in nitro-muriatic acid, evaporates to dryness the solution, and dissolves the product in a liquid containing 576 grains of yellow prussiate of potash and 144 grains of caustic potash; the mixture is then boiled during a half-hour, after which it is filtered and diluted with a sufficient quantity of water to give to the bath the weight of 340 grammes. After this the bath will be found composed in the following manner:—

Gold	...	...	...	...	1 part.
Yellow prussiate of potash	...	...	...	...	12 "
Caustic potash	...	...	...	...	3 "
Water	...	...	...	...	120 "

—*Oesterreich. Gewerbeblatt, through Bulletin de la Société d'Encouragement, No. 16, August, 1854, p. 506.*

MANUFACTURES FROM MINERAL SUBSTANCES.

Action of Sea Water upon Cement.—In No. IX., p. 269, of this Journal, we gave an account of the observations of MM. Malaguti and Durocher, upon the action of sea water upon hydraulic cements. According to these chemists, cements which contain peroxide of iron always resist the destructive action of sea water better than those containing but little; indeed they seem to consider the indestructibility to be in a direct ratio to the amount of iron. M. Vicat, who has done so much on this subject, has, however, communicated to the Academy of Sciences a number of well established cases in direct opposition to this view.

Cements indestructible in Sea Water.

	Percentage of Peroxide of Iron.
Medina Cement, employed at Cherbourg	12.05
Caher's cement tested in the laboratory during 7 to 8 years ...	5.50

These two cements have actually the same value for sea water.

Cements slightly attacked.

Pouilly Cement	5.10
Vassy cement, baked, average	7.35
Portland Cement	5.30

These three cements crack on the edges after some months of immersion.

Cements exceedingly destructible.

Cement of Guetary (Basses Pyrénées)	5.90
--------------------------------------------	------

This cement perishes after some days immersion.

Volcanic Puzzolanas.

Puzzolana, from Rome, standing well in sea water, with fat lime	12.00
Do. brown, of Naples, insufficient under the same circumstances,	16.80
Do. Island of Bourbon, still worse, average	35.00
All the puzzolanas of the Volcanoes of the Vivarais, very bad, average,	20.00

Artificial Puzzolanas.

All the artificial puzzolanas made with white clays, and properly applied, resist the action of sea water. There are some which contain no iron. Those containing most yield from 1.20 to 2.00.

Hydraulic Limes.

The famous limes of Ardèche, known under the name of Theil limes, the only ones which, up to the present, can be authentically shown to yield, with sand alone, mortars which are not destroyed by the action of sea water, contain only insignificant quantities of peroxide of iron, and sometimes contain none at all. Excellent limes suited for fresh water, and which contain as much as 9 per cent. of peroxide of iron, have yielded mortars with sand which perish in sea water in a few years.

These facts, M. Vicat seems to think, are sufficient to show that the importance attributed to peroxide of iron by MM. Malaguti and Durocher are not borne out generally, however well it may accord with a few exceptional cases. The best hydraulic compositions are, without exception, attackable by sea water when they are immersed in it fresh; to appreciate their value properly, it is necessary that they should have acquired cohesion, more or less advanced, *under certain conditions.*—*Comptes Rendus de l'Academie, 28th of August, 1854.*

MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

Machinery for making Spikes.—John Wootton, of Boonton, New Jersey, has obtained a patent for an improvement in machinery employed in making nails and spikes. Cut nails are clipped or cut out from metal plates by reciprocating knives, and are not made tapering. They have usually been made with one set of die rolls, and have not been very perfect, the sides being more or less feathered. By the improved machinery square nails or spikes are tapered on all sides, and drawn to a point; this is effected by two sets of die rolls, the one set forms the spike with its taper, and the other set takes it from the first and finishes it smooth and tapering.—*Scientific American, September 16th, 1854.*

Tempering and flattening Saws.—An improvement in the mode of tempering and flattening saws has been patented by William Clemson, of Boston, United States. It consists of two iron plates placed horizontally one above the other, these plates being heated over a suitable fireplace. The tempering and flattening of the saw are effected simultaneously by drawing the saw between the heated plates. As the saw passes between, it absorbs sufficient heat from the plates to effect the necessary tempering, while the flattening is done by the pressure of the upper plate. When a saw has been previously hardened it requires to receive a certain degree of heat before passing through the plates; if not sufficiently heated it will break during the process. On the other hand, if too hot it will spring back to its original unevenness after having been drawn through. To prevent this the edges of the plates, where the saw enters, are levelled in such a manner that before the saw arrives between them, every part of it becomes heated by radiation.—*Scientific American, September 9th.*

Sawing Machinery.—Charles F. Packard, of Greenwich, Connecticut, has patented an improvement in sawing machines for sawing laths, pickets, &c., direct from the log. It consists in the use of a vertical circular or reciprocating saw, and a series of horizontal circular saws, the latter being placed upon one shaft at a suitable distance apart, said shaft being attached to a vibrating bed operated in such a manner that the horizontal saws will be thrown outward from the carriage and log when these are moved in one direction, and then thrown towards the carriage and log when they are moved in the opposite direction. When the horizontal saws are thrown in towards the log, they cut into it the exact distance of the width of the pickets, laths, or whatever stuff they may be cutting, but do not separate them from the log; after they are thrown out when the log carriage has travelled to the end of the way, the vertical cutting saw is thrown into gear or action, and it cuts out the series of pickets or laths from the logs.

Condenser for Wool Carding Machines.—William H. Howard, of the City of Philadelphia has obtained a patent for improvements in woollen condensers. The invention consists in a means of keeping several slivers separate, and effectually preventing long staples becoming entangled when being conducted from the doffer to the condensing apparatus. The spools on which the slivers are wound are so placed in guides that the full spools can be removed and the empty ones substituted without waste of material, or interruption of the work. The doffer roller is divided into sections by spaces, and the lower roll is divided into corresponding sections by discs, so that the long staple of several slivers, is conducted forward without ever becoming entangled.—*Scientific American, September 2.*

Sewing Machines.—About five years ago we do not believe there were more than three or four sewing machines in use in the United States, now they can be counted by thousands. They are found in the factories and in the private dwellings, sewing the coarse bag and the most delicate piece of cambric. These machines since they were first introduced have advanced towards perfection with a rapidity that is truly astonishing. So many patents have already been obtained for improvements, that it is very difficult to keep pace with their progress; this is evidence of their importance, and at the same time, it is a sign that applications of them for various purposes, demand new modifications, devices, and arrangements. A patent has been obtained by Charles Parham, of Philadelphia, for a sewing machine combining two threads, a shuttle and needle, the object of which is to dispense with the shuttle race, in order to obviate the friction attendant on its use, and which, requiring oil to lubricate it, often soils delicate articles. He employs a shuttle carrier in which the shuttle fits so as to allow it to pass through the loop, but requires no movement independent of the one which is given to the carrier, and which requires no fixed guide to produce friction, excepting on the side which does not come in contact with the threads.

Perry's Breech-loading Rifle.—The peculiarity of the breech-loading fire arm consists in the combination of a vibratory charge holder working on an arbor in a socket, and moving in a circle; a magazine or tube in the breach for fifty percussion caps, a piercing cone in connexion with the exploding nipple, which introduces the fire to the centre of the cartridge, producing instant explosion;

also a tube forming an adjustable gas joint with the barrel, and so arranged as to be self-cleaning in the joint, which prevents any obstruction by rapid firing; all combined so as to introduce each charge separately and without breaking the cartridge, a single cap being at the same time placed upon the nipple. The charge-chamber is a little larger than the bore of the barrel, so as to prevent windage, and give the same advantage as the Minie ball does to muzzle loaders. It can also be charged with powder and patch, and no cartridge used if desired, as the breach-chamber is loaded like a common shot gun. This rifle is said to possess one-third greater penetrating power with one-sixth less powder than any muzzle-loading one. A ball fired from this rifle has penetrated through a target composed of 18 pine boards, each one inch thick, and an inch apart, at a distance of 80 yards. It was originally patented in 1849, but a second one is now to be taken out for improvements.—*Scientific American*, September 16th.

Comparison of Iron and Wooden Vessels.—In a note attached to his translation of Finchan's Outline of Ship-building, M. Nillus, of Havre, makes some interesting remarks on the comparative advantages of wooden and iron vessels, which we here present in an abridged form.

Almost all vessels, whether in wood or iron, have hitherto been constructed on a wrong principle. The greatest possible strength has been given to the sides and bottom, while the deck has been neglected. But a ship should be regarded as a great tube or box, capable of sustaining a load at its middle while suspended at its ends, or conversely of sustaining loads at each end while supported at the middle.

To obtain this result with the least weight of materials the upper and lower parts of the vessel, otherwise the *deck and the bottom, should be the strongest*. Instead of this the deck is usually slight and weak, and is generally regarded only as a platform to be used for working the ship, or as a covering to keep the water from the interior of the hull.

Iron ships should form a tube, closed at each end, and strengthened by ribs and cross-beams forming continuous pieces, so that the tube might be considered as strengthened by a series of rings. The sides should, of course, be rivetted to the ribs, so that the whole would form something analogous to a tubular bridge. Even the present construction of iron steamers is much superior in solidity to that of wooden ships, as a few examples will suffice to show. The Great Britain remained during the entire length of a severe winter fixed on the rocks at Dunrum, and when released from her critical position was capable of being so repaired as to become a packet-ship to Australia. A recent example is furnished by the *Ward Queen*, constructed by Scott Russel, with a length twelve times as great as her maximum breadth, a very high proportion for a sea-going vessel. This small steamer was employed between New Haven and Dieppe at the period of the accident. In entering the port of New Haven, at low water, with the channel too shallow, she grounded heavily and was suspended by the middle. A breaker took her broadside on and cast her on the beach, where the passengers easily and safely disembarked. Notwithstanding the force with which she was cast ashore she was again launched without any strain, and was able to proceed to London for examination. After a careful inspection no important injury could be discovered. A wooden vessel of the same dimensions, under similar circumstances, would doubtless go to pieces, or at least be seriously damaged.

To show that the annual cost of wear and tear is less with iron than with wooden vessels, M. Nillus refers to two steamers, each of ninety horse power, on the packet service between Dover and Calais. One of these, the *Midyeon*, is of wood, and cost £10,121. The other, the *Dover*, is of iron, and cost £10,153. The annual repairs of the *Midyeon* cost £668, while those of the *Dover* cost only £293. The wooden vessel thus requires 6.6 per cent. of her first cost for annual wear and tear, while only 2.87 per cent. of the first cost is required for the iron vessel. This extraordinary proportion in the relative cost of wear and tear in these two vessels might be, in part, attributed to the *Midyeon* being two years older than the *Dover*, but this would be far from completely explaining it.

Hitherto iron vessels have entirely failed for the purposes of war. Numerous

experiments made in France and England have clearly demonstrated their inapplicability. A ball fired at an iron hull strikes the side, and continuing its course right through, will come out at the other side; sometimes it breaks into dangerous splinters which kill and wound in all directions. Moreover it is impossible to perfectly close up the hole left by a cannon ball in the iron plate from the jagged edge turned to the interior of the ship. M. Nillus concludes that iron is much preferable to wood as the material for merchant and passenger vessels, but is entirely unsuited for the construction of ships of war.

ART. V.—*Bulletin of Industrial Statistics.*

STATISTICAL FACTS FROM THE FOURTEENTH REPORT OF THE FLAX IMPROVEMENT SOCIETY OF IRELAND.

Effects of the War upon the Imports of Flax.—As 60,000 tons out of 80,000 tons, constituting the average annual import of flax into these countries, and fully two-thirds to three-fourths of the flax seed employed in Ireland come from Russia, it was reasonably anticipated that a war with that country would seriously affect our supplies of flax and seed. Owing, however, to the neutrality of Prussia, and the permission to import Russian produce through her ports, no disturbance has taken place in the supply for this year, which has been on the contrary rather larger than usual. The total import from all parts for the year ended the 5th of October, 1854, was 86,837 tons of flax against 74,418 in the same period of 1852-53: no reliance, however, can be placed on the future.

The Irish Flax Crop of 1854.—The entire area of land under flax this year has been 150,972 acres against 174,589 acres in 1853, or a diminution of 23,607 acres, or about 14 per cent. The falling off is not so great as had been anticipated, owing to the exertions of the society in the spring. The average annual growth from 1847 to 1853 inclusive, was 103,939 acres, so that the crop of 1854 is about 50 per cent. above the average of the previous seven years. If 1853 be left out, the annual average of the preceding six years is reduced to 89,677 acres, and this year's crop is nearly 67 per cent. greater than that average. In 1853 the yield of flax was very much under an average, and did not yield the usual profit to the farmer; but it is believed, that notwithstanding the diminution in the area of land under flax, that the quantity of marketable fibre this year will be equal to that of last year's crop, and its value may be roughly estimated at about two millions sterling. The quality is generally of the lower kinds; the fibre is strong, and yields well in the spinning mills.

The Society's Practical Instruction.—The usual grant of £1,000 from the Irish Reproductive Fund having been granted this year to defray the expenses of practical instruction in certain counties of the South and West, this branch of the Society's operations was on the same scale as formerly. Nineteen instructors were employed at the usual seasons in imparting practical information to flax growers. They were located in districts of the following counties:—Donegal, Londonderry, Down, Cavan, Leitrim, Sligo, Mayo, Galway, Roscommon, Longford, Westmeath, Meath, Louth, Wexford, Cork, Kerry, Clare, Limerick, and Tipperary.

Markets in the new Flax districts of the South and West.—The first attempt to establish a round of markets in the new flax districts having been successful, especially in inspiring confidence among growers, the committee again arranged for holding flax markets in last March in Cork, Limerick, Athlone, and Ennis-corthy, where about 50 tons of fibre were disposed of. In order to increase the stimulant afforded by these local markets, the committee gave £20 in prizes for the best quality, and for the largest quantity of flax sold in each. The highest price obtained was £84 per ton, and the largest quantity sold by an individual was 12 tons.

Saving of Seed.—The importance of saving the seed of the flax crop is now, thanks to the exertions of the Flax Society, beginning to be fully appreciated.

All the retteries, of course, save their seed. One large landed proprietor in the County of Cork has the produce of 2,400 Irish acres, and a mercantile firm in Derry holds 2,000 barrels.

Rippling has been practised to rather more than the usual extent this year, and a trade is beginning to spring up in some of the inland towns, of purchasing the seed from farmers and selling it to crushers and cattle feeders, a system which, by affording a market in the spot, will encourage the sowing of seed.

The oil mills erected in the interior of the country, chiefly through the exertions of Mr. de Cock Kenifeck, the Society's Belgian Instructor, are now working, and if others are erected it will still further favour the saving of the seed.

The prejudice against sowing with home-saved seed in many localities is dying away, and several satisfactory communications have been received as to its excellence. On the other hand, the use of unsound or badly saved seed has deterred many from repeating the experiment.

New Scutch Mills erected.—In 1853 the number of scutch mills in Ireland was 1,056, with 5,871 stocks, against 956 mills, with 5,053 stocks in 1852, being an increase in the year of 100 mills and 718 stocks. In the provinces of Leinster, Munster, and Connaught, the number of mills were the same as in 1852, but the number of stocks increased from 331 to 356, and 3 worthless old mills had been pulled down, and three others, of modern construction, had replaced them in other districts. Since these returns were drawn up, information has been received of the erection of new scutch mills in various places in the Counties of Meath, Wexford, Cork, Clare, Galway, Leitrim, and Roscommon. This is highly satisfactory, since no real progress can be made in any district entering on the culture of flax, without such means being provided for the preparation of the fibre for the market.

Exports of Irish Flax and Tow.—One of the most interesting features marking the great increase of flax cultivation in Ireland, is the rapid augmentation of our export of flax and tow chiefly to great Britain, but also to some extent to France, and in small quantities to other foreign countries. So late as 1850 the export of Irish flax and tow was but 3,166 tons. Of the crop of 1852, 6,696 tons of flax and 2,308 of tow, in all 9,004 tons, value £392,500, were exported. Of the crop of 1853 the large amount of 7,486 tons of flax and 2,763 tons of tow, in all 10,249 tons, value £505,989, were shipped from Ireland to England, Scotland, and France. If at the time the Flax Society was founded, it had ventured to predict that besides supplying her own extensive wants, Ireland would export in one year to the value of upwards of half-a-million sterling of the raw produce of her flax fields, very few individuals would have placed any faith in such a prediction.

Cultivation of Hemp.—About 40 acres of hemp were grown this year in Cork, at the suggestion and under the direction of Mr. de Cock Kenifeck, the Society's Belgian Instructor. The cultivation of hemp deserves great attention, when we recollect that 60,000 tons are annually exported into Great Britain and Ireland, the value of which may be estimated at about £1,800,000.

New varieties of Flax.—The attention of the committee of the Flax Society has been for some time directed to the probability of finding a variety of the flax plant which might furnish a larger yield and a finer quality of fibre. Some seed of two new varieties was procured, both producing white flowers; one reported to be indigenous to Guiana, and the other a chance variety with yellowish seeds, discovered in Ohio. Several members of the society have grown these seeds experimentally, and have reported upon the results, but as yet no decided opinion can be formed upon the possible advantages of either.

Other Fibrous Plants.—Some experimental surveys have also been made with the seeds of the Bokhara clover, (*melilotus arborea*), and of the China grass, *Urtica Nivea*, the results of which are not yet in a state to be published.

Conversion of Flax Tow into Wool.—It appears that although the Chevallier Claussen's scheme to convert flax fibre into a substitute for low qualities of cotton, has completely failed, yet that scutching tow, if subjected to Claussen's process, is converted into a substance well adapted for mixing with wool, and that in Scotland and in Belgium establishments are very successful on this principle.

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ART. I.—*On Fish Manure.*

WEALTH in Ireland is estimated by income, and the great object of all exertion appears to be to attain a comfortable one. Hence, if a Railway is to be made, or a Steam Navigation Company got up, land to be purchased under the Incumbered Estates Court, or a Joint Stock Bank to be established, all of which have but little of a speculative character, and, consequently, yield, comparatively speaking, steady returns, abundance of money can at once be found. But if some new and promising branch of trade is to be introduced, or even an old established one extended, it is nearly impossible to induce Irish capitalists to invest money in it, simply because there is risk, and the income might not be steady. Our capitalists are merely money-lenders and bill discounters, and would prefer to obtain a small quiet profit in that way, to making a fortune by some bold speculation which would involve some trouble and risk. The cause of this is no doubt provincialism, and the disorganization produced by ages of oppression, which have so eaten into our souls, that the energy required for speculation has nearly died out in Ireland.

In England and France, amongst the manufacturing and trading classes, and in America generally, the standard of wealth is commonly estimated by the total capital which an individual possesses; and whatever that may be, he is as ready to risk a fourth, or even the half of it, as an Irish capitalist would the fourth or the half of his income.

When we shall have completely revolutionized our ideas in this respect, for we have undoubtedly commenced doing so, it is difficult to say, but it is certainly most unfortunate that hitherto they have impeded our taking advantage of our unrivalled geographical position, and of our 1000 miles of oceanic coast. If boasting could do us any good, our splendid harbours, in which it is so often said all the navies of the world could ride, would ere this have been supplied with at least a few fleets of fishing smacks.

As an example of the want of that speculative enterprise of which we are speaking, we may point to the condition of our fisheries, in which, comparatively speaking, so little real progress has of late been made. It is now just one year since we drew attention, in the first number of this Journal, to the important application which might be made of fish offal and marine

exuvie to the manufacture of an artificial manure. In that article we endeavoured to show that fish contains the elements of an excellent manure; that a portable material possessing all the properties of the fish unimpaired can be made from it; and that under favourable conditions, *and carried on by individual enterprise*, there is a wide and profitable field open to small capitalists; and lastly, we dwelt upon the benefits which the establishment of such a branch of manufacture, if properly carried out, would confer upon our fishing trade. We regret that our words fell upon a barren soil—those who have the capital in Ireland, with the exception of parts of Ulster, are all merchants, and take no interest in manufactures, and even if they did, would not speculate; while those who would have the energy to carry out an enterprise, are ignorant of the means and have no capital. We shall leave our landed proprietors entirely out of question, for, owing to the unfortunate system according to which they are educated, with few honourable exceptions, they are above doing anything which would have any connection with manufactures, even if they knew how.

The importance of this field of industry has, however, been fully appreciated in France, and a factory has been established at Concarneau, in the Department of Finisterre, as we briefly indicated at page 279 in the first volume of this Journal. A full report of a visit to the factory having since been made by the distinguished chemist, M. Payen, and the well-known agriculturist, M. Pommier, to the French Agricultural Society, we purpose presenting our readers with the chief points contained in that report, in the hope that another year may not pass over without some attempt of the like kind being made upon our coasts.

The experiments which led to the establishment of the factory, of which we are now to speak, were made by a M. de Molon, and have extended over a period of four years. On several occasions he had employed the offal obtained in the preparation of Sardines, on the coast of Brittany, to manure his land in Finisterre. The results which he obtained led him to imagine that this offal, and a multitude of marine fish of little commercial value, might furnish an important resource to agriculture. This fact, observed since a long time, especially in countries where deep-sea fishing is a permanent industry, was not new; but, such a manure was by its very nature restricted to the agriculture of the coasts—fish or fish offal not being capable of being economically transported more than short distances. It is also evident that these materials should be immediately employed—that they are not susceptible of preservation, and that the manure not admitting of being applied to the soil, except at certain seasons, it must at once be evident, that the employment of fish offal, spite of its richness in fecundating elements, could never be generalized, or offer large resources to agriculture.

M. de Molon, however, conceived that a far vaster and more advantageous agricultural resource might be drawn from this inexhaustible wealth of the ocean, by so treating the offal of the coast fisheries, and the immense quantities of common fish which are of no use to the fishermen, as to insure their preservation, concentrate their fecundatory properties, and render them as transportable as Peruvian guano—to do, in fine, what we have shown to be practicable in our former article.

M. de Molon made a number of experiments from this point of view, and finally settled upon this plan: To boil the fish; to extract as much as possible of the water and oil which they contain; dry them and reduce them to powder. After he had obtained this powder in a perfectly dry state he had it analysed, first by M. Moride, at Nantes; then at Rennes, by M. Malaguti; and finally, by M. Payen, in Paris.

These analyses several times repeated, yielded as a mean the following per centage results:—

Water,	...	...	...	...	...	1.00
Nitrogenous organic matter,	...	...	...	...	...	80.10
Soluble salts, consisting principally of chloride of sodium,						
carbonate of ammonia, and traces of sulphate,	...	...	...	...	...	4.50
Phosphate of lime and magnesia,	..	..	..	..	..	14.10
Carbonate of lime	...	...	..	..	..	0.06
Silica,	...	...	...	...	...	0.02
Magnesia and loss	...	...	...	...	...	0.22
						100.00

In other words these repeated analyses indicate that dried fish powder would contain about—

12 per cent of nitrogen, and
14 " of bone earth,

that is to say, it would be nearly as rich as the best Peruvian guano. (According to the results of analyses made on herrings, given at page 10, vol. I, of this Journal, an average manure made from that fish, and containing 10 per cent of water, would contain about $13\frac{1}{3}$ per cent of nitrogen, and between 11 and 12 per cent of bone earth. The small fish containing but little bone earth accounts for the difference in both cases.) To the scientific analysis M. de Molon wished to add the sanction of practice; he applied 400 kilogrammes (880.8 lbs.) per hectare (2 acres, 1 rood, and 35 perches), or 3 cwt. 0 qr. 20 lbs. per statute acre, of the fish powder; half in autumn and half in spring, as a top dressing to wheat. The results which he obtained were so evident, that his doubts were dissipated, his conviction became full and entire, and he resolved to make every effort to discover a means of rendering as economical as possible the manufacture of a manure equally powerful, and which should advantageously compete with Peruvian guano.

Having made his calculations, his ideas were at once directed to Newfoundland, where the produce of the cod fishery in a fresh condition amounts to more than 1,400,000 tons per annum.

The cod, previous to being salted and dried, is deprived of its head, its intestines, and the back bone, which together make about one-half of its total weight. This offal, which amounts to at least 700,000 tons, is thrown into the sea, or is lost without utility.

In 1850, M. de Molon fitted out a vessel, and confided his project to one of his brothers, furnishing him with the utensils necessary to experiment upon, and manufacture the fish powder. The results of this voyage confirmed his anticipations, and M. de Molon, junior, brought back to France a certain quantity of fish manure, which was found to be identical in composition with that manufactured in France.

In 1851, M. de Molon, junior, again departed for Newfoundland, taking

with him all the means of manufacturing, the materials necessary to construct a factory, and houses for 150 workmen, whom he also took with him; finally, all the means necessary to found a permanent establishment. He fixed himself at Kerpon, at the extremity of the island, near the Strait of Belle-Isle, on a creek which was visited every year by a great number of fishing vessels, and whose shores abound in fish. At present this establishment is in regular work, and has, we believe, sent within the last two or three months a considerable quantity of fish manure to France.

Whilst his younger brother was thus establishing himself in Newfoundland, M. de Molon wished to have in France an establishment of the same kind placed immediately under his own eyes, which would serve to perfect the process of manufacture, and offer to all the practical confirmation of facts, the importance of which had long since been indelibly fixed upon his own mind. It was at this epoch that M. de Molon associated himself with a M. Thurnyssen, who understood the vast field of enterprise which was thus opened up.

This factory was erected by them at Concarneau, between Lorient and Brest, in the department of Finisterre. This is a mere fishing village, not far from the town of Quimper, containing scarcely 2000 inhabitants, and built upon a rock in the middle of a bay formed by the ocean. The catching and preparation of the Sardine, which employs about 300 to 400 boats annually, is almost the only industry of the district, if we except a factory for the manufacture of iodine.

The factory of M.M. de Molon and Thurnyssen is placed at the end of the port, and the boats come and discharge their fish under its walls. In its actual condition, this factory is capable of manufacturing daily about 4 to 5 tons of fish manure, in a perfectly dry condition, which represents 16 to 20 tons of fish or of fish offal in its fresh state.* The proprietors receive all the offal of the curing houses of Concarneau and those of Lorient; and in addition, all the coarse fish which were previously thrown into the sea, or which were even abandoned on the very quays of Concarneau, to the great detriment of public health.

The factory is entirely constructed of deal planks, that is to say, with all the economy possible; and contains the following articles as plant: a steam engine of 10 horse power, and a boiler of 18-horse power; 2 boiling pans *a la bascule*, with steam jackets for boiling the fish at the temperature of a water bath; 24 screw presses, to press the material when boiled; a rasp exactly similar to those employed in beet sugar factories; a large stove; a Chaussonot's coccle furnace, for heating the stove; a conical iron mill, similar to a coffee mill.

The following is the mode of employing these various utensils: The fish or the offal is introduced by the upper part of the boiling pans into the interior, one of which is capable of containing about 10 cwt., and the other from 16 cwt. to one ton. The vessel is then hermetically closed, and steam of about 50 to 55 lbs. pressure admitted into the steam jacket, the steam room of which is about 2 inches wide, and into a tube nearly 8 inches in diameter,

* At page 309, vol. I. of this Journal, will be found a notice of the experiments of Messrs. Payen and Wood upon the relative compositions of the different fishes used as food, which gives some valuable information upon the quantity of solid matter which different kinds of fish are capable of yielding.

placed vertically in the interior of the pan. The boiling is completed in an hour; then by a simple movement the pan may be made to swing upon its bearings, the steam allowed to escape, and the cover being removed, the boiled fish is allowed to fall into a receptacle. Workmen then convey it in baskets to the presses placed alongside the boilers.

The great difficulty was to find a means of submitting this fish magma to the action of the press without losing the fine portions. This was accomplished in this way: under each of the presses is placed a cylinder of sheet iron open at both ends, about 20 inches high, and 12 inches in diameter. This cylinder is strengthened by 4 small iron rings or hoops, and is pierced with a number of very fine holes. A loose bottom or wooden plate is fitted into this cylinder, which is then nearly filled with the boiled fish, and upon this is laid another plate of wood similar to the bottom. One or two blocks are then laid upon this cover, and when all the cylinders are filled, a man turns alternately the screw of each press. In proportion as the pressure operates, the water and oil contained in the fish is seen to exude from the perforations of the cylinder. These liquids flow into gutters which conduct them to a common channel by which they flow into barrels placed underneath, and so graduated that when the first is filled, the overflow passes into the second, and so on in succession, without the intervention of any workman. After reposing for some time, the oil floats on the surface, and is collected and stored in barrels in the cellar. The average quantity of fish oil thus extracted represents very nearly $2\frac{1}{2}$ per cent of the fresh fish.

When the boiled mass is sufficiently pressed, the presses are loosened, and the cylinders removed and turned upside down, close to the reservoir, to allow any liquid which may have mounted to the surface to flow away; on then tapping the bottom wooden plate, the pressed mass may be taken out of the cylinder in the form of two compact cakes, about 4 inches in thickness. These cakes are immediately conveyed by a workman to the hopper of the rasp, placed close at hand; this rasp, set in motion by the steam engine, reduces the cakes to a sort of pulp, which is carried by children as fast as formed to the stove.

This stove, situate on the first floor, is externally 20 metres long (65 feet $7\frac{1}{2}$ inches), and 5 metres (16 feet 5 inches, nearly) wide; it is divided lengthwise into 5 chambers, 85 centimetres (2 feet $9\frac{1}{2}$ inches nearly) wide. Each of these chambers contains in its length 20 frames or trays, 1 metre (3 feet $3\frac{1}{2}$ inches) long, and 85 centimetres (2 feet $9\frac{1}{2}$ inches nearly) wide, having a bottom of coarse linen. These trays rest upon two bars, which run the whole length of the chamber. Five series of such trays are superimposed in each chamber, which makes 100 in each chamber, or 500 in the whole stove. At each end of these chambers is a number of openings, which can be closed by a door; each opening corresponds with a series of trays.

When the rasped fish-cake is put upon a frame, it is introduced into the stove through one of the openings just mentioned; a second is then introduced, which causes the first to slide along the bars; then a third, and so on until twenty have been placed. The second series of trays is then introduced in the same way by the opening next above. The operation

is proceeded with in this way until the five series are introduced into each of the five chambers. It takes about 2 hours to fill the stove with the 500 trays, which it is capable of containing.

A current of air, heated by the coccle oven of Chaussonot to a temperature of from 140° to 158° Far., circulates through the five chambers, according as each is filled with the trays of fish, the draught being maintained by a chimney.

As soon as the last tray is introduced into the stove, the first is fit to be withdrawn. This is effected in the simplest manner; a child placed at one extremity of the stove introduces a tray freshly charged, this pushes without any effort the whole series ranged upon the bars, and causes the last in the series at the lower end of the stove to slide out, where it is received by another child; a fresh tray is again introduced, and another is pushed out, and so on for the whole stove. In this way the action of the stove is constant, being filled as fast as it is emptied, without the workpeople being exposed to the action of the heat, and without suffering in the least from it, and being, nevertheless, able to communicate to one another the details of the work, the chambers acting as conductors for the voice.

This stove constitutes one of the most important features in the system of M. de Molon; it dries rapidly, regularly, and with comparatively small expenditure of heat, since 100 kilogrammes (220 lbs.) of coal a day are sufficient for heating the coccle; and the continuity of its action is perfect.

According as the dried fish is withdrawn from the chambers it is thrown into a heap, on a board close by, from which it is put with a shovel into the mill hopper by a child. The mill reduces it to a sufficiently fine and perfectly dry powder, which is at once put in sacks or casks, and sealed, in order that there may be no means of adulterating it.

To any one acquainted with the processes and machinery employed in the manufacture of beet sugar, it will at once be evident, that the organization of the process just described was the result of an acquaintance with that manufacture. This is another instance of the benefits conferred upon France by the beet sugar industry, for to that branch of manufacture it may be truly said to owe the rise of its present manufacturing system. A branch of industry requiring a combination of chemical and mechanical skill carried on in the midst of a rural population, especially if connected with agriculture, has far more influence upon the permanent prosperity of a people materially and intellectually, than the greatest branch of industry entirely confined to the civic population.

To carry on all the operations just described, only six men are employed at Concarneau, who receive about 1s. a day, and ten children, who receive from sixpence to sevenpence. Under those conditions, and without working at night, this factory is capable, as we have already remarked, of producing from four to five tons of dry manure a day, representing about 18 to 20 tons of fish or offal; that is 100 parts of fresh fish yield about 22 parts of fish powder. By working at night, which will be done during the ensuing year, when the fishery shall have been better organized, this establishment will be able to produce from 8 to 10 tons of manure. M. de Molon estimates the number of days in the year during which the fishermen could fish, at from 200 to 250. In only counting 200 working days, the estab-

lishment at Concarneau could thus produce from 1600 to 2000 tons of manure annually, which at the rate of 3 cwts. per statute acre, would suffice to manure from 10,000 to 13,000 acres of land; and would represent at 22 per cent. of dried manure, a fishing of from 9,000 to 10,000 tons. The Sardine fishery and the offal of the curing houses, formerly lost, would furnish about one half of that quantity; but M. de Molon has pointed out a fact from which would appear to result the incontestible facility of obtaining at Concarneau, far greater quantities of fish than those mentioned above, by the fishery of the coal fish, which is sometimes found in immense quantities on the coast, but which the fishermen do not often take, as they could find no sale for them.

The factory of Concarneau, with the organized fishery, which M. de Molon intends to establish (60 to 78 well equipped boats), and by doubling its present plant, which is also intended, will quadruple the quantity of dry manure which is now produced in working only 10 hours per day.

In addition to the 180 kilogrammes of coal burned in heating the stove, we may add that 130 more ($286\frac{1}{2}$ lbs.) are consumed by the steam engine, making a total of 230 kilogrammes, or a little more than $4\frac{1}{2}$ cwts, or about one cwt. of coal to one ton of manure.

The fish manure fetches about 8s. per cwt. in the locality, and is eagerly sought after by the farmers, who expect the most signal results to agriculture, from the extension of the manufacture; while the oil which, as already remarked, constitutes about $2\frac{1}{2}$ per cent. of the raw fish, would be worth from 3s. to 3s. 4d. per gallon. These figures show at once that the manufacture must be profitable—a fact which is fully guaranteed by Messrs. Payen and Pommier, who, as a commission sent from the Agricultural Society, in order to report upon the project, had the privilege of examining the books of the concern, and of thus satisfying themselves of its commercial success.

The factory of Concarneau, as we have already noticed, was only founded in order to serve as a model, not alone for those which may be established on different points of the French coast, but also in foreign countries. In addition to the factory established under the superintendence of M. de Molon, junior, in Newfoundland, and which in its actual condition is capable of furnishing from 8,000 to 10,000 tons of manure annually, it is proposed to establish others on the same coast, and also on the coasts of the North Sea, on such a scale as will furnish sufficient manure to completely replace the guano now imported from Peru.

When we recollect what a large amount of offal has hitherto been wasted upon our coasts, the vast quantity of coarse fish which have been rejected, and thrown again into the sea; but above all, when we consider the enormous extent of ocean, teeming with animal life, which has contributed so little towards the sustenance of mankind, we cannot help thinking that at Concarneau has been laid the foundation of a great branch of industry, which is destined to renovate the worn out soils of the richly populated countries of Europe.

For such an industry Ireland is peculiarly favoured by position, and wants but the enterprise and perseverance of a few individuals to develop it. Again we say who will be the *pioneer*?

**ART. II.—On a Self-acting Sewer Flusher and Ventilator. Patented by
JOHN GRAY, M. D.**

THERE is a very prevalent opinion, that the exhalations from putrescent animal or vegetable matter are capable of generating disease, especially that of an epidemic and contagious character; and that localities where the putrefaction of animal or vegetable substances is going on are most subject to such diseases, and that those diseases are there most fatal. In the sewers underlying all large cities, we have such a state of putrefaction in its most active form; and whatever value we may attach to the opinion just stated, there can be no doubt that the breathing of air tainted by such exhalations is not very conducive to health. Breathing air containing sulphuretted hydrogen or similar gases, if it does not induce positive disease, diminishes the vitality of the persons constantly subjected to its action, and renders them less capable of resisting the attacks of disease. Hitherto the system of sewerage in common use was admirably adapted to the generation of putrid exhalations, and the drain sewers into the main ones were still more so; and, indeed, we must unfortunately say, still are equally well adapted to be so many conducting pipes for conveying those exhalations into our houses. And having got there the arrangements for their diffusion through the house, are, in many places, even still better. This is especially the case in Dublin, where the absurd system of making subterraneous kitchens prevails; these act as receivers, from which a constant current proceeds up our staircases, accompanied by a combination of various other odours derived from the culinary operations going on below, and are thence distributed to each apartment.

The radical remedy for all this would doubtless be to prevent our sewers acting as generators, by removing constantly all accumulations of matter which could putrify; this, of course, could only be done by washing or flushing them from time to time with large bodies of water, let in at the extremities of all the ramifications of the sewerage. Such a process has been more than once proposed, but in order to employ it the whole sewerage must be in a perfect condition, and built according to certain principles. But in the present condition of the supply of water it would be an expensive process. All we can hope to do, therefore, is to shut off the communication, as well as we can, between the street sewers and our houses, and for this purpose numerous contrivances have been invented, among which the common D trap is, perhaps the best, and, yet, from our experience of it, as at present available, it is liable to get out of order continually.

Dr. Gray, of this city, who has devoted a considerable amount of attention to this class of subjects, has lately patented an apparatus which prevents this derangement of the trap, which instead of placing in the house, he places at the end of the drain pipe, where it discharges itself into the street sewer. This position of the trap involves, of course, the necessity of keeping the drain pipe perfectly clean, which he proposes to effect by regular flushings at fixed periods. As this object could never be effected if it required the attendance of a person to open a cock or valve at the proper time, Dr. Gray has invented a self-acting

flushing apparatus for that purpose. Having had an opportunity of examining the apparatus, and seeing it in action on a full working scale, on the occasion of its public exhibition by Dr. Gray, in the Corporation Yard, in Winetavern-street, in this city, before a large number of the principal citizens of Dublin, interested in sanitary measures, we have become convinced of its great utility, and have, therefore, hastened to bring it fully under the notice of our readers. It is exceedingly ingenious, and is remarkable for its simplicity—this, indeed, is one of its most important features. It may be made of copper, zinc, or tin plate, by any tin man, and may be repaired with the greatest facility in the most out of the way town in the country, and is, therefore, free from the disadvantages which so frequently attends many ingenious contrivances, namely, the difficulty of getting them repaired except by the maker. The whole mechanism could also be procured for a few shillings, so that its cost cannot be a barrier to its use.

The self-acting sewer flusher and ventilator consists essentially of a cistern, in the bottom of which is inserted a circular valve seat 5 inches in diameter, having a *small* supply-pipe, the flow of which is regulated by a nozzle and a self-acting apparatus for opening and closing the valve at the proper periods.

The self-acting apparatus is formed by an arrangement, which brings *suddenly* into action the buoyancy of a powerful float which has connection with the discharge valve of the cistern, and carries it up off the valve seat, so as to allow the discharge of the water, and then allows it *gradually* to recover its position and close the *valvular opening* in the cistern. This is effected by an ingenious but very simple contrivance. The float is not placed in the general cistern, but in a *separate one* fixed in the general one, and in connection with this separate cistern or float chamber is a reservoir, which contains enough of water to bring the buoyancy of the float into action. This reservoir receives water from the cistern in the same proportion as it is admitted into the cistern by the supply pipe, and fills *very slowly*; when full, an arrangement is made to allow its contents to flow suddenly through a *large opening* into the bottom of the float chamber, and thus send up the float, which carries with it the valve, which is itself buoyant in water, and thus opens the discharge hole in the cistern. The water in the cistern is thus allowed to flow off, and yet the float remains up, keeping the valve also with it. The float is let down again by a small syphon, which slowly discharges the water let into the float chamber, and thus gradually lets down the valve to its former position, so as to close the valvular opening and allow the cistern to become again filled.

The valve is peculiarly constructed, and admirably suited to the purpose. It consists of a hollow cylindrical tube the full width of the entire opening, and within a few inches of the entire depth to which the water is allowed to attain. By this adaptation the water pressure on the valve is gotten rid of, and the valve once removed from its seat, instead of being a dead weight on the float, aids it by its buoyancy, and actually bounds upwards when liberated, falling again as the water bed descends, but being caught by the float before it has fully descended, and it is then gradually let down by the descent of the float to its place, so as to close the valve opening.

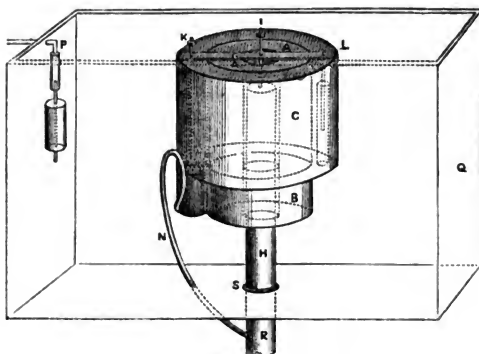


Fig. 1.

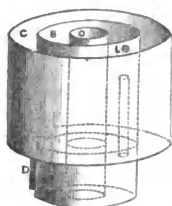


Fig. 2.

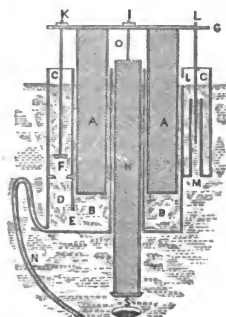


Fig. 3.

We shall now proceed to describe the mechanism in detail. Fig. 1 represents a cistern provided with the flushing valve, which is shown lifted off its seat, the remainder of the apparatus being shown in the position which it would have when the valve would be closed, and a perspective view of the self-acting apparatus for lifting it. Fig. 2 is a perspective view of part of the lifting apparatus, showing the peculiar arrangement of the different chambers, and in fig. 3 the same mechanism, including the valve itself, is shown in section, the whole self-acting apparatus being shown, lifted up so as to exhibit the valve seat S. The position of the valve H with respect to the other part of the apparatus is that which it ought to have when closed. P, fig. 1, is the supply pipe, with the peculiarly constructed ball-cock to be described subsequently, for regulating the supply of water. A

is the float lying down in the float chamber B, fig. 2. B, fig. 1, is the external wall of the float chamber, C is a reservoir which surrounds the upper portion of the float chamber, its inner wall being formed by the outer wall B, of the float chamber, the two thus forming annular concentric chambers. In fig. 3 A represents a section of the float, which is an annular drum, B the float chamber in which it lies, and C the reservoir. D, figs. 2, 3, is a pipe connecting the bottom of the reservoir C with the float chamber B, into which it opens directly at E, fig. 3. F, fig. 3, is a valve which shuts off the connection between the reservoir and the float chamber when at rest, and allows water to flow from the former into the latter when it is lifted. G, figs. 1 and 3, is a bar called the lift bar, which crosses the opening in the centre in the annular drum or float, and is attached to the latter. In its centre is a hole, through which the guide rod attached to the float H moves up and down. This guide rod is surmounted by a head or button, I, which limits the motion of the valve, and enables the bar G to lift the valve H. A similar button, K, is fixed upon the rod of the valve F, by means of which it is lifted. L, fig. 3, is a guide rod, but unconnected with a valve placed at the opposite side of the reservoir to the valve F, in order to steady the motion of the float, the top of this rod is seen at L in fig. 1, where it issues through, and is fixed to the lift bar. M is a tube soldered into the bottom of the reservoir, and rising a certain height in it, through which the water in the cistern enters the self-acting apparatus. N, figs. 1 and 3, a small syphon pipe, which passes through one of the sides of the cistern A, for discharging the water from the float chamber into the pipe outside the cistern leading from the valve to the street sewer. O is the cylindrical opening or pipe formed by the inner wall of the float chamber, through which the cistern valve H passes in its upward and downward motion. S, fig. 3, the valve seat, consisting of an annular disk of vulcanized India rubber, with the discharging orifice in the centre, opening into the pipe R, shown in fig. 1, leading to the drain pipe. S, fig. 1, shows the neck of the valve H, which fits into the valve seat on the top of the flushing pipe R, and which is not shown in this figure.

By the aid of this description it will now be easy to understand the mode of action of the apparatus. We shall suppose that it is desired to flush a sewer once in the twenty-four hours, and to employ for that purpose 25 or 50 gallons of water, the cistern, which may be a wine or whiskey butt, is obtained of the requisite size to hold that quantity, and the supply pipe so regulated that it will discharge 25 or 50 gallons of water, as the case may be, into the cistern in the twenty-four hours. When the water rises in the cistern to the level of the bottom of the reservoir, C, it will enter the orifice of the pipe M, and will ascend in it in proportion as the cistern fills. As soon as it reaches the top of the tube M, it will flow into the reservoir C, which it will gradually fill up to the level of a notch or lip in its inner wall. Having reached that height it will flow over the lip into the float chamber B, and after a moment will slightly lift the float, carrying with it the lift bar; as the bar rises it meets the button, K, on the end of the spindle of the drop valve F, which is screwed down to a plane three-fourths of an inch lower than that of the discharge valve H, and thus lifts the valve F, but not the valve H. The

opening of the valve F, allows a large volume of water to rapidly rush by the pipe D, and the orifice E, into the float chamber B, and to suddenly lift, with a sort of jerk, the float, the lift bar of which strikes the button I, on the spindle or guide rod of the valve H, which it carries up with it, and thus opens the discharging orifice.

If no means existed for now emptying the float chamber, the valve would always remain open, but by a very simple and ingenious arrangement, this is effected as the flushing proceeds. When the water is at its full height it fills the small syphon N, and hence, as soon as the level of the water in the cistern has begun to sink from its discharge through the valve orifice and pipe R, the syphon commences to empty the float chamber, into which no more water can enter after the level has sunk below the top of the pipe M; according as the float chamber is emptied, the float descends and allows the valve H to gradually fall, and finally close the valve orifice, when the operation recommences. With such an arrangement the only portion of the water consumed, which does not act as a flushing agent, is the portion thus discharged by the syphon, and the quantity which flows in while the valve remains open. As the self-acting apparatus is very small when compared with the cistern, the loss from the first source is quite unimportant. That from the second is scarcely more so, as the time that the valve remains open is not more than two or three minutes, during which but little water would flow into the cistern, as a mere dribble would be sufficient to work it at intervals of twelve hours.

In our illustrations we have shown one form of the apparatus, but Dr. Gray has constructed a modification which differs from that described and illustrated, in having no reservoir. Fig. 3 will still, however, serve to explain this new form of the apparatus. In the first place we may suppose that portion of the reservoir C, shown on the right of the section, fig. 3, with its connecting pipe M, removed; while the drop valve F, is placed on a pipe situated at the sides of the cistern, instead of forming part of an annular reservoir. The part of the reservoir C, with the valve F on the left, may be considered as the section of this pipe. In this case, however, we must suppose it a continuous pipe reaching from the point E, where it would enter the float-chamber B, to a point below C (on the left hand), and just about the $\frac{1}{8}$ of an inch below the water-level, as shown in the section; at this point, that is on the top of the pipe, just beneath the surface of the water, the valve F would be placed. This valve would therefore reach to within a short distance of the level of the lip or opening L, fig. 3, and would of course be acted upon in the same way as where the reservoir C, as above described, would be employed, but differs from it in this, that when the valve F, in the new arrangement, is raised, the supply intended to act on the float, so as to open the delivery valve, is drawn from the *general cistern*. When the cistern has a large superficial area, and is not *deep*, this modified arrangement is found to answer perfectly well. Where the cistern is large in proportion to the area of the discharge valve, the reservoir is useful by maintaining a continued supply for the float-chamber until the cistern shall have been discharged. In ordinary cases where the modification without the reservoir could be employed, it would obviously be much less complex, and consequently, less expensive, than the apparatus with the reservoir.



Fig. 4.

In our fourth figure we have given a view of the flusher and drain pipe, with the S or D trap entering the street sewer, in order to illustrate the ventilating action of the arrangement, to which Dr. Gray, in his explanatory statement, attributes an importance second only to the scouring or flushing action. Q, as in fig. 1, represents the cistern, and it is here represented in its supposed position above the kitchen or on the first floor, say 10 feet from the level of the kitchen floor; the upright leading from the bottom of the cistern A into the drain pipe T, corresponds with the pipe R, fig. 1; U is the D trap, and V its opening, and W, the street sewer.

The effect of this arrangement was demonstrated at the public trial of the apparatus to be, that the rapid flush coming down the vertical pipe condenses the air contained in the drain pipe, T, as it precludes its exit into the cistern. Driven onwards by the continuous flood, it eventually forces all the water in the bend, U, out, with a kind of explosion, and then rushes out into the street sewer, followed by the flush or scour of water, which sweeps all before it, and this scour is itself followed by a rush of air through the valve at the bottom of the cistern, which, when the water has all flowed off, completely fills the vertical and drain pipes with *atmospheric air*, which completely and most effectually ventilates the drain pipe, by changing the whole body of the air daily or bi-daily. The trap now washed out remains full of water, and acts as a seal, preventing any foul air from returning into the drain pipe, thus any air liberated back into the closet *must* be *atmospheric air* only, for that only fills the drain pipe. So great is the force of the flush that gravel, lumps of mortar, and even stones, placed in the bottom of the bend U, are shot out with considerable force, so that no fear need be entertained that such a drain pipe would ever get choked if regularly flushed, unless by the introduction of some large object which would not easily pass through the pipe. This trap is itself a new idea, and is a necessary complement to the flushing apparatus, which it renders perfect.

Dr. Gray has attached a clock work mechanism to his apparatus, so as to enable him to register the number of times it has acted. By this means it becomes a water meter; and in case the apparatus comes into general use, this self-registering mechanism will afford a ready means to water companies who sell their water by measure, to estimate how much water is used for this special purpose.

In conclusion we may observe that Dr. Gray's self-flushing apparatus is not only applicable to flush house drains, but if made of sufficient size, is

equally adapted for flushing the main sewers of a city. Many other uses of the apparatus, besides that of flushing, will, we are confident, suggest themselves to our readers.

ART. III.—*On the Preservation and Storage of Corn, by the method of*
M. HENRI HUART, of Cambrai.

[In vol. I., page 279 of this Journal, we made a few observations upon the method of storing corn adopted by the Messrs. Huart, the celebrated millers of Cambrai. Since then a complete description of the machinery has been published in the *Publication Industrielle of Armengaud*. As there are few subjects of more immediate importance to those countries than that of storing grain, we purpose giving in full the description of MM. Huart's machinery given by the Messrs. Armengaud, accompanied by the necessary engravings. We also purpose noticing several other methods recently proposed for purifying grain, such as that of M. Doyère for destroying weevils and other insects. It is not merely to the machinery for grinding wheat and bolting flour that the immense progress made of late years by French millers is to be altogether attributed. It is as much, perhaps, to their systems of purifying and preserving their grain. We therefore wish to direct the serious attention of Irish millers to the present article upon that subject, and to the future ones which we intend to devote to the different branches of the trade in corn, the manufacture of flour and bread.]

MORE than thirty-five years ago a philanthropic member of the administrative Council of the Society for the Encouragement of Manufactures of France, M. d'Artigues, said, with reference to the preservation of corn:—"From the periods of dearth which often afflict France, and to the relief of which the previous years of abundance afford no help, it is obvious that he who would invent a method of preserving, easily, securely, and cheaply, the corn of abundant years, would render the greatest possible service to the country and to humanity. The hope of profit induces many to run the risk which is incurred by the preservation of corn, as well as the expense and loss occasioned by this preservation, to amass it in abundant years, with the view of selling it in times of scarcity. But the number of these merchants, who cannot be too much encouraged, has much diminished, owing to the fears, embarrassment, and expense, which are the inevitable consequence of the storage of large quantities of corn. France especially is far behind other nations in this kind of speculation. During years of abundance, foreigners purchase our best corn from us at a low price, and when deficient crops occur, they bring it back much deteriorated, and sell it at a very high price."

According to a skilful agriculturist, M. de Gasparin, of the Academy of Sciences, the total amount of corn of all kinds stored in France, is 75 millions of hectolitres (25,792,500 quarters), reduced to their equivalent in wheat, deductions being made of seeds and oats. Now, if there are years of abundance, which produce, on the average, 20 per cent. as surplus, in every country, there are also years of dearth, which are deficient by 6, 8, and even 10 millions of hectolitres, as for instance, in the years 1847 and 1853. M. Tardieu, Professor to the Faculty of Medicine, states, in his *Dictionnaire d'Hygiène Publique*, that from 1829 to 1840, the importation of wheat in grain and flour rose to 271 millions of francs (£10,848,000) while the exportation has been only 43 millions at the average price of 20 francs (16s.) the hectolitre [46s. 6d. the quarter].

From this, we perceive of what importance a good system of reserve would be, not alone for France, but for all civilised nations. The question, however, is so complex and difficult, that many years elapsed ere it was perfectly solved. For its complete solution, we think it should unite the following conditions:—

1. To preserve the corn during an indefinite time;
2. To improve while preserving it;
3. To operate on considerable quantities, without employing great space; and—
4. To effect, besides, a saving in the expense of management and storage.

It is thus that M. Huart, of Cambrai, has conceived this interesting problem, and we must say, that he has solved it in the most ingenious and satisfactory manner. The author, who, as an intelligent and experienced manufacturer, has been occupied for some years in the milling trade, has laid it down as a principle, that corn completely cleansed, purged from destructive insects, from dust, and from the foreign substances which it contains, can be preserved indefinitely after having been brought to this condition of purity by a continued movement, which exposes it to the constant action of currents of cold air.

For ourselves, we have been thoroughly convinced of the important results obtained by M. Huart, by visiting his establishment at Cambrai, where we have watched with the greatest interest all the experiments which are renewed there every day on considerable quantities of corn. We feel that great perseverance, and at the same time, an earnest desire to effect a benevolent purpose, was requisite on the part of the inventor, in labouring at so difficult a subject, which has occupied the most enlightened minds, and in the expense daily incurred by all kinds of experiments.

The improved method now in operation at M. Huart's, and which we may term a great moveable granary, has the double merit of containing from three to four times more corn, in equal space than existing granaries in the best condition, requiring less original outlay, entailing incomparably less expense of maintenance, and effectively preserving masses of corn during several years.

In order to render the question more clear, we have thought it advisable to trace what has been previously done on the same subject. We have thus been enabled to compare with ease different methods, and to be convinced of the superiority of this system.

Before giving a detailed description of it, we think it will not be uninteresting to many of our readers to know the various methods of preservation which have been successively proposed during the last fifty years. The summary which we are going to make will have the advantage besides of proving how much public attention has been occupied with that important question, "the preservation of corn," which interests equally agriculture, the welfare of individuals, and the public happiness and security, and which, at various epochs, has attracted the attention of the Government as well as that of all those benevolent men who endeavour to apply their acquired knowledge to the perfection of the social condition of mankind.

*Historical Notice of the Preservation of Corn.**

"The most fertile countries," says M. de Gasparin, in his able report to the Academy of Sciences, "countries which generally produce more than is required for their subsistence, may be exposed to the effects of dearth by many physical accidents, and the simplest plan which could be devised for remedying them is that which, in the most remote times, Joseph proposed to Pharaoh, when, foreseeing the years of sterility which were to succeed seven years of abundance, he induced him to accumulate, during the abundant years, the surplus produce which should assist in supplying the deficiency of the others." This was also practised in China. With these two nations, who had voluntarily interdicted all foreign commerce, the accumulation of reserves was a necessity, unless the surplus were wholly wasted, and this necessity afterwards prevented the evil caused by the forced isolation of these countries.

Granaries of reserve were also established at Berne, which, by its topographical situation, far from coasts, and in the midst of mountains, could with difficulty procure the corn that, in the event of scarcity, it would require.

But, save these exceptional cases—rendered such by circumstances—reserves of corn have been often projected, but have never been carried out. The decree of the Convention of the 9th of August, 1793, has remained a dead letter, in the *Bulletin des Lois*, and the constructions raised by Napoleon, who had the provisioning of Paris alone in view, have not fulfilled the purpose for which he had destined them.

Causes of the Alteration of Corn.

Before indicating the means of preservation which have been proposed, we must remark, with a distinguished chemist, M. Payen, who made a report in 1837, to the Society for the Encouragement of Manufactures, on an investigation proposed relative to the preservation of corn and the testing of flour:—*

That the infection of corn by the eggs of alucites take place even in the fields, before the sheaves are gathered in; and that *larvæ* are subsequently developed, attack and devour the interior of the grain, become then metamorphosed, and reproduce moths:

That humidity in corn is one of the principal causes of its subsequent deterioration; that it occasions a commencement of germination in the ears themselves, and later, those modifications more or less injurious, which result from spontaneous fermentation among the embryos, the seed vessels and their teguments:

That weevils in general attack corn only when it is stored, and are propagated only by means of the shelter and nourishment afforded them by granaries accessible in all parts.

* The Society then founded a prize of 4,000 francs, to be awarded in 1841, to the author of the best method of preserving corn in fields and stores; and a second prize of 4,500 francs for the best mode of purifying corn attacked by insects and infected by rot. These prizes have been successively deferred for the *concours* of 1843 and 1845, and, in fine, have never been carried off.

The first precautions should then be applied during the harvest, which should be made at the most opportune time, as soon as the grain is perfectly ripened; then the corn should be rapidly thrashed, in order to subject it immediately to the conditions of storage which have been adopted. For this purpose mechanical thrashing would be often more advantageous to agriculturists, by not leaving the success of the preservation dependent on the inequalities of manual operations. After these precautions, every means of economically producing, as soon as the thrashing is over, a dessication of the corn sufficient to prevent fermentation and mouldiness, and the propagation of insects; then a storage which would prevent the recurrence of the same injurious causes, would unite the conditions necessary for the solution of the problem.

Chemical Processes.

Since 1808, the following facts were communicated to the Society for the Encouragement of Manufactures:—1. That M. Van den Driesche had found that the blossom of the elder tree was capable of removing the weevils and worms which introduce themselves into corn and flour. 2. That M. de Jaguet, *sous-préfet* at La Réole, attributed the same property to muriatic acid gas. 3. That M. Decamp, of Cambrai, had also observed that insects do not attack corn preserved on boards on which onion seed has been dried.*

M. de Dombasle had also proposed the application of sulphureous acid gas for developed insects, and M. Robin had formed a special apparatus for the destruction of the eggs and *larvæ* of alucites.

In October, 1839, MM. Stombe, Brothers, of Ribemont (Aisne), obtained a patent of importation for five years, for a method to prevent rot in corn-seed. It is thus described: 1. A hectolitre† of seed is steeped in 64 litres of water (14½ gallons). 2. Into this are thrown two French pounds of common salt, ½ ounce of arsenic, and a similar quantity of alum, ¼ ounce of crushed garlic, and $\frac{2}{10}$ of a litre of water, in which is introduced $\frac{1}{16}$ of a litre of spirits of wine, and an equal quantity of ether. 3. After the corn has steeped for half an hour in this composition, it is withdrawn from the water, and placed in a vat, containing half a hectolitre, in order to allow it to drain for the space of a quarter of an hour, after which the contents of the vat are deposited in the granary. 4. On this mass are thrown eight decilitres of slack-lime; the heap is left in this position only three hours, after which the grain can be used for sowing. 5. The same water will serve until exhausted, but the quantity of corn must be diminished in the same proportion in which the volume of water is lessened; and when the quantity of water is increased, a dose of the above composition should be added, corresponding to the additional quantity of water. 6. By means of this method, even black corn may be used as seed, by

* This method has been recently found very effective, and has been brought under the notice of the *Société d'Agriculture* by the Minister of Commerce and Public Works.

† 2½ bushels nearly.

which the quality of corn is improved. 7. In every condition of climate or of temperature, and by whomsoever it may be used, the above preservative is stated to be infallible. M. Ledaux, of Bonny-sur-Loire, also demanded a patent in 1845, for a method of preservation by carbonic acid. For this purpose he enclosed the corn in cylinders of thin sheet iron, to which he communicated a rotatory movement, and through which he sent currents of gas, with a pressure of from two to three atmospheres, leaving the corn in this state until delivery. In fine, on the 18th of June, 1852, MM. Bizet and Gaultier de Claubry, obtained respectively a patent of fifteen years for a process they elaborately describe, and which consists simply in the employment of chlorine, sent in the required quantities through the chambers which contain the corn.

This method, well known to agriculturists, and perhaps the only one now used in France, diminishes the effects of the spontaneous alteration of corn, and evidently checks the reproduction of insects; but as regards wet years, old stores infected by weevils, and corn attacked by alucites, it is altogether insufficient, an incontestible proof of which, says M. Payen, is furnished by the enormous losses suffered from these causes in France. We should add, that this process is besides expensive, both from the expertness which it requires, and from the expense in building to which it leads.

Of Corn Pits.

Pits for the preservation of corn, a method which has been attempted to be introduced among us, are much availed of in southern countries, in which their use has been mentioned by Greek and Latin authors. Corn has been thus preserved, from time immemorial, in a great part of Asia, Africa, and even of Europe.

M. Terneaux, one of the most skilful manufacturers at the commencement of this century, and who has rendered signal services to industry, constructed in 1819 and 1820, on his property at Saint Ouen, two pits, each containing nearly 200 hectolitres of corn ($68\frac{3}{4}$ quarters.) The first pit was 4 metres ($13\frac{1}{2}$ ft.) in depth, and 3 metres 50 centimetres in diameter; it was lined to 2 metres 30 centimetres in height, with ordinary masonry, forming a vault, terminated by an edge, which rose 20 centimetres (about 8 inches) above the ground. The walls of this pit, from the base to the top rim, were furnished with a coating of rye-straw, 25 centimetres (10 inches nearly) thick, supported by osier twigs passed through iron hooks placed at regular distances. The bottom of the pit was covered with a bed of basket-work, 32 centimetres thick, and a long layer of rye-straw, on which was placed a straw matting roughly twisted, and the whole was pressed and trodden down so as to admit the least possible air. The 10th of December following, and during rainy weather, M. Terneaux, deposited in this pit 199 hectolitres of wheat of good quality, tolerably dry, and possessing neither taste nor smell. After having filled the pit as far as possible with straw, the lower aperture was closed with an oaken cover, the aperture was filled with stones, its mouth hermetically closed with a slab, stopped with plaster, and the whole finally covered with earth arising from the excavation.

The pit having been opened on the 10th of October, 1820, it was found that, on the quantity of corn which had remained in it during six months and a half, only about a single hectolitre had contracted a faint mouldy smell; a circumstance which is naturally explained by the immediate contact of this quantity with the upper portion of the pit, the masonry of which had been recently constructed. The remainder was found in a perfect state of preservation, and produced flour of superior quality, and bread of an excellent flavour, similar to that made with corn preserved by the ordinary method.

In 1822, M. de Lasteyrie was appointed, in the name of a special commission, to draw up a report to the *Société d'Encouragement*, on the results obtained by such a method, which appeared to him to possess many advantages, as he speaks very favourably of it, and proves the good state of preservation in which the corn was found on opening the pits. A little later, in 1823, he communicated the various experiments which were made with similar apparatus in a very elaborate report, in which he considers the advantages which agriculture, commerce, and population would derive from a simple, sure, and economic preservation of corn. "Corn can be preserved in pits," says M. de Lasteyrie, "during one, two, and three years, and even longer, when enveloped in a strong lining of straw, when the ground is sufficiently solid to support this kind of structure, and when the soil is of such a nature as not to admit *too much moisture*, or an infiltration of rain-water. It is necessary to remark, that even in countries where the custom of preserving corn in pits is generally adopted, unwallled pits are very rarely employed, it having been observed that corn cannot be long preserved in them without being deteriorated. This method has been used only in those districts where the soil is such as not to give access to infiltrations of water. Such is the case in Tuscany, where some small farmers thus deposit their corn for one or two years; while the proprietors, who can wait for high prices, retain it in walled pits during an indeterminate number of years. In Poland, corn is also thrown into pits lined with straw, in years of abundance; but the low price of this provision admits of the loss of a certain quantity, in order to preserve the greater part of the harvest." Farther on, M. de Lasteyrie says in his report:—"The experiments which have been made at Roule, have not had the results which would have been expected, had all the necessary precautions been taken. The first pit, constructed of rough stones, and lined with a sheet of lead, was filled with corn, and then covered with another sheet, folded like the first; the whole was covered with a straw matting, a thin coat of sand, and a second thick layer of lime. In spite of these precautions, however, moisture had penetrated through the joinings of the lead, and the lime, combining with the carbonic acid gas, produced by the fermentation of the corn, and thus augmenting the proportion of oxygen, rendered the air fit for the respiration of insects, which have been found even in the midst of the pit, and which have occasioned severe damage. The air of this pit, on being analyzed by M. Vanquelin, yielded no excess of carbonic acid: thus the means employed against humidity has not been able to prevent it entirely, and has been fatal to the corn by adapting the air to the respiration and subsistence of insects. The second pit of the Magazine of Roule, was hollowed in

the earth, and had neither vault nor walls. Some faggots were burned in it in order to dry and harden the sides, which were lined with straw, before the grain was thrown in. The preservatives were not very successful in this pit; mouldiness appeared in some parts; weevils attacked the corn, and were found even to a third of the height. The activity of these insects must be attributed, as in the preceding pit, to the presence of lime. In the third pit, which was constructed of brick, a brick lining without mortar had been built to within a decimetre of the walls: thus the humidity of the soil having found greater access, in spite of the lime with which the pit had been covered, the mass of corn damaged was more considerable, and the insects, having a greater quantity of air, were found at the surface as well as at the bottom of the corn. Other experiments have been also tried at the storehouse of Roule. Corn enclosed in a large freestone vessel, and covered with a sheet of lead, without the addition of lime, gave no indication of weevils, and was found in good preservation, but the swelling of the corn having split the vessel, the corn in contact with the fissure had contracted mouldiness. Three other vessels were placed in a subterranean vault, two of which, enveloped with straw and well covered, were found to have, one, the corn gnawed by weevils, and the other damaged by humidity, but without weevils; finally, the third, which consisted of an immense freestone jar, with a narrow neck closed by a sheet of lead, was the only one in which the corn was perfectly preserved, and in which it suffered no damage either from moisture or from weevils. From all these facts we must then conclude, that corn has been, and must be, deteriorated when it is not sufficiently secured against moisture, and when the air, rendered fit for respiration by the presence of lime, is thus capable of supporting the vitality of insects.

We cannot omit speaking of a store formed of thick oak planks in one of the vaults of the granary of reserve. Corn was perfectly preserved in it for the space of a year, with the exception of a little moisture in some parts of it immediately next the walls. These sort of wooden chambers can be employed with advantage in certain circumstances; but their price, so high when compared with their durability, admits of their employment only in very few localities. Besides, the influence of moisture, heat, or of cold, may, according to the position in which it is placed, produce effects on the corn which would tend to deteriorate or destroy it, if left in these chambers for many years; the joining of the planks would even give access to the external air, which would permit weevils to live and exert their ravages. At the Hospital of St. Louis, two pits were formed for the preservation of corn, in case of dearth, for ten years; they were of rough millstones, with a thick coat of lime, with layers of bitumen, cement, litharge, and oil, and lastly with linings of thin lime and sand.

After having dug the pit, the bottom was lined with pebbles, over which were placed slabs of dry millstone, and on this the base of the pits was formed with millstones cemented with thin mortar and sand. The construction of lateral walls has been varied by joining bricks, rough stones, and millstones sometimes with thick lime, sometimes with thin; in fine, these different portions of walls have been left without lining in some places, while in

others they have been covered with a layer of thin lime and sand, or with one of bitumen or cement composed of powdered brick, litharge, and oil. The exterior walls were enveloped in a layer of coarse sand, about the thickness of two decimetres (7·87 inches). This precaution was taken in order that the rain-water, in penetrating the soil, should not lodge against the walls of the pit or at its base. In order to render the layers of lime and sand impervious to moisture, care was taken to carbonate them by burning charcoal several times in the interior of the pits.

These pits having been constructed with the various combinations of materials and with the precautions indicated above, 126 hectolitres of corn ($43\frac{1}{2}$ quarters nearly) were poured into one, and into the other, $131\frac{1}{2}$ (45 quarters), supplied by the granary of Paris. The pits were closed up, and the official report of this operation was sent to the Minister of the Interior. These pits having been opened after the lapse of twelve months, the member of the commission charged by the Minister with the direction of these operations, transmitted to his excellency the official report, which proved the condition of the corn and that of the pits. The Council of Food Supplies for Paris has also drawn up reports in order to testify to the existence of the same condition.

The results of the various observations which have been made during the extraction of the corn, and after its entire discharge, are: that the corn which was next the layers of thin carbonated mortar, or next those of bitumen, or finally, next those of oil and litharge, was found dry and in a perfect state of preservation, while the corn next the walls which had no lining, was mouldy or rotted to a depth of from 25 to 75 millimetres (1 to 3 inches nearly). Similar results were obtained in the two pits, an identical connection found between the same modes of construction; so that a double certainty has been acquired on the efficiency or imperfection of the methods employed in the double experiment made on the two pits, and that we can assert, that the end proposed in this experiment has been perfectly attained.

In 1819, Count Dejean, Director General of Military Provisions, also constructed, with the permission of the Minister of War, three receptacles composed of lead, of cylindrical form, two millimetres thick, and sunk into two blocks of stones. These receptacles, eight cubic metres in capacity (10·464 cubic yards), were placed in different situations, one in a cave, the other on the ground floor, and the third in the first story, before a window facing the south. Having been filled with corn of good quality, and perfectly sound, on the 15th of November, 1819, they were opened on the 20th of November the following year, when the grain appeared in the most perfect state of preservation, with the exception of one which contained grain of an inferior quality, which emitted a milky odour, but which, however, disappeared after being exposed for some hours to the open air. General Demarçay, who had long perceived the disadvantages of ordinary granaries, converted an old ice-house situated on his property into a sort of corn-pit, by constructing therein a kind of wooden chest, separated from the walls only by the width of two small vertical beams, on which the planks that enter into its construction are nailed. The bottom of the

chest is rather more distant from the floor of the ice-house; and this arrangement has a double object: to isolate the sides of the chest from the walls of the ice-house, and to allow the air to circulate freely in the space which separates them. The ice-house is covered with a roof of straw, to which M. Demarçay attributes a great power of dessication. He conceives that the moist vapours which are evolved from the floor and from the walls of the ice-house, rapidly ascend to the straw roofing, into which they penetrate the more easily, as this covering is exposed to currents of air and the action of the sun.

The chest being filled with corn to about three feet from the top, two or three coverings or diaphragms of planks well joined, are placed above the corn, at the distance of about a foot from each other, in order to resist the movement of the internal air, and thus prevent it from becoming warm.

Twelve years' experience has given the most satisfactory results. The same corn has remained even three consecutive years in the pit, without suffering the slightest deterioration; it had always the appearance and colour of one year's corn; but corn taken from the pit in February, and placed on the first floor of a granary under tiles, acquired in two months sufficient humidity to weigh two kilogrammes ($4\frac{1}{2}$ lbs.) the hectolitre more than at the time of its withdrawal from the pit; it was swollen, and rolled with great difficulty. Among those who have been occupied with the preservation of corn in pits, we will mention the Marquis de Saint Croix, Mr. Donald Cunie, of London, and M. Godin, a land-owner and manufacturer at Petit-Bagneux, who procured patents for the modes of construction which they proposed from 1828 to 1830.

Finally, although the method of preserving in pits has been sanctioned by experience in southern nations, and may be regarded as efficient, it has not, however, been adopted in France, on the one hand, because it is too expensive, and on the other, because few countries possess the kind of soil suitable for these pits, or the materials necessary for their construction.

Besides, this method requires an amount of care and precaution which cannot be always taken. If corn has been thus preserved in Spain, Turkey, Tuscany, &c., it arises from the favourable influence of climate, and from peculiar circumstances which are not found in the greater part of France. At Leghorn, for instance, where there exists so large a trade in corn, they do not try, as we have always done here, to keep corn enclosed for two or three years without taking further trouble with it; but they take it from the pits every three or four months, to spread and expose it by shifting it to the air upon a dry platform. The straw pads which lined the interior of the pits are taken out, dried, and repaired; the pits are then filled with the same precautions as the first time, and are closed by means of a slab, which is then covered with earth. The propagation of any partial deterioration through the mass is thus prevented, and the grain kept in a very good state of preservation. At Florence and Pisa, where the pits remain filled for a longer time, the same precautions are taken. We should not omit to notice the favourable influence of climate on those useful operations, which will enable us also to comprehend clearly the efficacy of the usual methods which have been followed on several estates in this country.

They consist in thrashing the corn immediately after it is gathered in, then pouring the clean corn either into large freestone jars, or into vats raised above the ground, and covered with staves or rough stones. The mouths of the jars thus carefully filled, are often covered with a thick layer of small hard beans, which weevils never attack, and which preserve the contents. We perceive also how such precautions must prevent the propagation of the most pernicious insects. They would, doubtless, be suitable for this country, were it not for the habitual humidity of the atmosphere, which would render them inefficient.

Preservation in Sacks.

* Parmentier, and others who have thought much on the preservation of corn, disapproved of the employment of pits, and recommended that corn should be enclosed in sacks, isolated from each other, stating that this means is preferable, that it would protect the corn from the danger of heating, that it would partially check the multiplication of weevils, the production of moths, the depredations of mice, and the filth of cats. But as this method is very expensive, requires much space, and renders the airing of corn by shifting much more difficult, very few have been tempted to employ it.

Hoppers.

M. d'Artignes, whom we have already quoted, invented, towards 1818, an apparatus which appeared to him preferable to the preceding ones. It consisted of several wooden hoppers or boxes, 1 metre 15 centimetres square, placed at intervals of a foot one above the other, and having at the base an aperture of 8 centimetres ($3\frac{2}{10}$ inches) closed by a sliding lid. By this method, says the author, it is impossible for grain to become heated, it is easily aired, and can be shifted almost without expense, for it is sufficient to place under the lower hopper, raised 60 centimetres (23·62 inches) above the floor, a rolling chest, into which all the corn contained in the first hopper above the floor is made to fall; then the grain in falling, scatters of itself, especially when a plank, divided into parallel grooves, is placed under it.

After having thus emptied the lower box, the lid of its hopper is closed, and that of the second placed above is opened; the corn falls as before, and similarly with the others; so that in an instant one man has shifted a hundred hectolitres of corn (34·39 quarters)—each box being 12 decimetres in depth and 6 in mean width, is capable of containing from 8 to 9 hectolitres (from 22 to 24 $\frac{3}{4}$ bushels) without any other trouble than that of throwing the quantity drawn from the lower box into the upper one.*

* It would appear that M. Philip de Girard, to whom, as is well known, we are indebted for the essential principles of the machines for spinning flax, on returning to France about the period of the National Exhibition of 1844, had proposed analogous machines for the preservation of corn, with the application of mechanical means for sifting it. We would have much desired to see such a scheme carried out; but, unhappily, death snatched M. de Girard away in the midst of his new inventions.

Airing Machines.

In 1828, M. Laurent, senior, a Parisian machinist, took out a patent of fifteen years, for a system which he called *airing pit* or *anti-pit*, as it preserves corn only by surrounding it continually with air, while the ordinary reservoirs or pits, which are only, as he calls them, *stiflers*, preserve corn only by depriving it of air. The apparatus is composed of several vertical compartments, 4 metres in height (13·12 feet), as many in length, and from 13 to 14 centimetres in breadth (about $5\frac{1}{2}$ inches), each separated by intervals of 50 centimetres (19·68 inches nearly) for the circulation of air, during occasional repairs, and for sweeping; they are closed at the sides by iron plates, and furnished at the base with sliding doors, in order to empty them when necessary; the granary or store in which they are enclosed is provided with barred windows to light and air the whole interior. The inventor observes that this airing method has the advantage of preserving the corn for a long time without the expense of supervision, of saving it from the attacks of mice or birds, and from the ordure of cats, and that the structure endures for an indeterminate time. He recommends its use in stores infested by weevils, but not until their total extirpation.* He estimates that it can contain with a height of 4 metres, and an equal superficies, $\frac{7}{12}$ more corn than ordinary granaries, in which we can reckon only on layers of 50 centimetres.

M. Laurent, who estimates the expense of manipulation, sifting, and stowing at more than 40 fr. the hectolitre of corn (or about £4 13s. the quarter) stored in the granaries of the State, asserts that by his method there would be a saving of more than $\frac{2}{3}$ of the entire cost.

A patent of fifteen years has been recently applied for (22nd of November, 1852,) by M. Salaville, for a method of compartments with circulation of air, which seems to have much analogy to the preceding, only the author adds a ventilator that raises currents of air in each of the open spaces formed between the various layers of corn.

Methods of Washing and Drying.

An experienced agriculturist and close observer, M. Duhamel, to whom we owe valuable ideas and experiments on the subject, proposed many years since, a system of dessication by the action of currents of air gradually heated to 90° cent. (194° Fahrenheit), as an economic mode of checking the ravages of weevils and moths, and of securing the corn from the subsequent attacks of their offspring, provided that the grain were enclosed in large wooden chests closed tight, and placed above ground. He had

* "The weevil," says M. Laurent, "is a great destroyer of corn. On quitting the egg, the insect introduces itself into wheat and dry vegetables; it enlarges its lodging by consuming all the flour, after which it becomes a chrysalis. In order to issue from its prison, the weevil bores a hole with the point of its proboscis, and then pierces other grains for his subsistence." From the report of M. Lénier, to the Academy of Sciences, it results that in calculating on the mean of days on which the thermometer does not descend below 12° cent., twelve pairs of weevils can procreate 75,000 individuals of their species.

observed the deterioration which takes place during the intervals of stowing in the damp corn, as in that attacked by weevils. M.M. Wattabed and de Maupeau, comprehending the principle of M. Dubamel, have invented desiccating apparatus, stores, and drying-boards, for bringing corn damaged by insects, fermentation, or rot, to the requisite state of dryness. The patent obtained by M. Wattabed, dating from the 26th of June, 1829, is for a special machine which the inventor has termed an *octagon*, and which is characterized by the arrangement of four large upright posts, and four smaller, joined by a cast iron band, to which iron bars are bound, which support an open fire beneath, with a ventilator and thirty heating tubes.

A series of frames, covered with sheet iron, receive the corn which is to be heated or dried. Two additions, dated the 18th of January and the 13th of June, 1835, indicate some modifications applied to the method, and especially those which shew the substitution of the heated air to effect dessication, and the employment of fan blowers, to introduce cold or warm air into the interior of the apparatus. Such a method, executed indeed on a small scale, has not appeared to us of commercial importance.

M. de Maupeau's invention, patented from the 4th of December, 1834, is entitled, "Methods of purification and dessication, or of concentration, generally applicable to all solid or liquid substances, and particularly to corn." It consists of several successive operations, viz.: culling, steeping, washing in ley, drying, and heating. These various operations are all done mechanically.

In the first, the corn is immersed in a bath of spring water, contained in a suitable vat, and by a combination, on the principle of the difference of specific gravities, the effects of which it realises, a first separation is effected of sound corn from all that attacked by rats, bored, or inhabited by insects.

The corn thus culled, is immediately subjected, in its state of immersion, and in the same vat, to a violent movement of to and fro, by means of a system of fixed blades. By this movement repeated, with several successive scourings of water, and interrupted by intervals of repose, which complete the culling-process, the grain is washed, scoured, and purged. In certain cases, the corn receives, intermediate between two lotions of spring water, a ley-wash of a preparation of caustic potash. The object of this chemical application, says the author, is, without injuring the seed or the farinaceous substance, to destroy all vegetable parasite seeds internally and externally, all animal bodies in the state of egg, larvæ, worm, or insects, and finally, to expel all foreign taste or odour. This is succeeded by the fourth operation, that of drying, in which the corn is made to pass through a series of cylinders, arranged in graduated slopes, revolving in the midst of a ventilating chamber, of proportionate dimensions, forming a kind of kiln, through which a current of air, passing over a red hot fire, rapidly and constantly ascends. On quitting this apparatus, the corn passes through a similar system of cylinders, working in air of the ordinary or at a moderate temperature; it becomes completely dried, and at length acquires its natural and normal state. An addition to this patent, taken out the 15th of March, 1835, in the name of M. Fourcault, M. de

Maupeau's assignee, while retaining the gradual methods of washing, contains a modification in the construction of the drying cylinders, intended to graduate, according to requirement, the power of the apparatus to the magnitude of the establishment, or to the largest quantities of corn capable of being operated on. The same inventor has also obtained a new patent of fifteen years, the 13th of November, 1846, for some additional improvements in his method. But this process, which has made much noise for some years in the milling trade, has not been as generally used as had been hoped: with the exception of some large establishments, like those of La Villette, in Paris, it has not been adopted, in the first place in consequence of its very high price and the great expense of its maintenance, and in the next, because it was really too complicated, and would expose the mills to greater risk of being burned. About the same period, the 30th of September, 1835, M. Thomas, of Paris, procured a patent for an apparatus which he called a *drying cone*, intended to dry all kinds of grain, by operating on them either in their natural state, or after a previous washing. This apparatus, capable by its form and size of being placed on the carts used by cultivators, is composed of two rotating cones placed one within the other, constructed of wrought iron triangles and sheet iron, and containing bits of thin plates, notched and pointed. These were heated by means of a stove furnished with pipes, which traversed their interior. The grain, cast into a hopper, placed at the top, passed slowly between the cones during their rotation, and issued by the opposite extremity, after having been heated, without risk, to the required degree. We have yet to mention the patents obtained in France for this kind of process for some years; they are:—1. An apparatus for washing, drying, and cleansing corn and other cereals, patented the 5th of March, 1847, by M. Jovela. 2. The store with inclined planks, for preserving all kinds of grain from the influence of the atmosphere, for storing, drying, and purifying it, patented by Von Wiebeking, on the 27th of September, 1847. 3. M.M. Gazagnaire and Trône's process, to disinfect damaged corn, and render it sound, by a washing of hypo-chlorite of soda, a second washing in pure water, and drying in the air. 4. M. Olin-Chatelet's method (the 28th August, 1848), consisting of improvements applied to the Archimedean screw, and to spiral cylinders, intended to mix, dry, wash, and stupe flour, corn, and other substances, by means of water, air, and heat. 5. M.M. Asselin and Higgonet's apparatus, patented the 13th of December, 1850, for the methodical drying and preservation of corn, by direct application, as in the drying-loft of a brewery. 6. The machine patented by M. Baron, junior, for fifteen years, on the 21st of January, 1854, for washing, cleansing, and drying, by a continued process, grain of every description, or other substances. 7. The improvements applied by M.M. Millon and Monreu, the 23rd of February, 1853, to the treatment of corn, more especially as regards its washing, drying, grinding, soundness, and preservation.

But we shall return to the particular arrangements of these apparatus by describing more fully the processes of washing and drying corn.

Moveable Granaries.

An apparatus which created a sensation for some years, both in the learned and industrial world, is the *moveable granary*, patented the 28th of December, 1835, by M. Vallery, a manufacturer at Saint-Paul-sur-Risle (Eure), and has been the subject of favourable reports to the Academy of Sciences and the Society for the Encouragement of Manufactures. Though it has not been used by the trade, we think it right to describe its construction, which is not without interest, since it shows how much motion has been thought necessary for the preservation of corn. The following description of it was made to the Institute in 1838:—

This apparatus consists of a large cylinder of wood in separate compartments, turning horizontally on its axis. The external envelope of this cylinder is formed of staves of wood, firmly bound together by bands and screws. Numerous openings, symmetrically cut in all the staves, are cased with sheet iron; they admit the air, and afford an issue for the insects to fly out. The supports of all the apparatus are so arranged as to oppose an insuperable obstacle to the entrance of destructive insects. A slight roof is fixed on these supports, having a gutter round its edge, filled with water having a layer of oil upon it, or still better, simply with oil; the object of this roof is to prevent the admission of the vermin, whose instincts would lead them to descend from the roof on the apparatus in repose. The corn deposited in this apparatus ought not to fill it entirely, that it may roll more freely on itself; a ventilator, acting on the centrifugal-force principle, is placed at one of its extremities; this ventilator, by exhausting the air contained with the corn in the cylinder, forces the external air to traverse the grain, in order to replace it, and prevent an internal depression; the action of the ventilator is combined with the rotation of the cylinder, and the successive motion of all the corn contained in the cylinder facilitates a complete airing. In order to diminish considerably the force necessary for this mechanical stoving, M. Vallery disposed his corn in a series of compartments placed around a hollow tube, which remains always empty, and forms the centre of the whole system. This central tube serves for the efflux of the air exhausted by the ventilator. By this arrangement, the cases are kept in equilibrium, and only a few partial displacements from the centre of gravity require to be corrected.

It thus reduces the effort necessary to the movement of rotation in the proportion of 13 to 47. This arrangement has, besides, the advantage of subjecting the surfaces of all parts of the corn in succession to the action of ventilation. From experiments made on a grand scale by order of the Minister of Commerce, it has been proved that, after a motion of forty-eight hours, not more than 20 weevils have remained in 15 hectolitres, contained in one of the eight cases composing the cylinder, and infested by 37,950 weevils. All the insects had fled in large numbers during the motion communicated to the corn, and were found on the walls of the shed. As to humid corn, it was found that M. Vallery's apparatus was capable of ventilating and drying it completely.

From these experiments we may then conclude, that the moveable, ventilated, and isolated granary secures corn completely from ulterior ravages, by opposing an insurmountable barrier to the new insects which endeavour to introduce themselves; that it prevents fermentation in consequence of the airing to which it subjects corn; that it renders possible the moistening of corn which is too dry, by the facility which the ventilator affords for pressing air charged with vapour through the entire mass. This apparatus admits also of storing corn in a very limited space.

In 1839, M. Payen, reporter to the special commission charged by the Society for the Encouragement, &c., to examine M. Vallery's apparatus, stated, that it gives a remarkable saving in the cost of construction, especially in large cities in which corn stores are concentrated, and with all the necessary guarantees of solidity; that it greatly diminishes the cost of management so considerable in ordinary granaries; that it ensures the preservation of corn, by securing it from fermentation, by the expulsion of weevils, and by preventing their return; that it also secures corn from the ravages of rats, mice, and other animals; that it is perfectly adapted for the preservation of *oleaginous* and *leguminous grain*, and generally of all corn usually stored in granaries; finally, that the apparatus, which unites these advantages, has not the inconvenience of concealing the corn from the inspection of the proprietor, and that it will not be resisted by prejudices, since it is sustained by the old custom of moving and tumbling corn in the open air. The first apparatus submitted to the Academy contained only 165 hectolitres of corn, ($56\frac{3}{4}$ quarters,) and was not considered of a capacity sufficient to solve the commercial and economic question. That which was more recently examined by the Society for the Encouragement, &c., was capable of containing 1,106 hectolitres, or practically 1,000 hectolitres (344 quarters). Experiments made before the commission have proved its efficacy upon 1,150 hect., ($395\frac{1}{2}$ quarters,) weighing together 85,000 kilogrammes, (187,425 lbs.,) the weight of the apparatus alone being 20,000 kilogrammes. It was then an immense cylinder 9 metres in length, ($29\frac{1}{2}$ feet,) and 4 m. 66 centimes in diameter, receiving a very slow, and at the same time a very regular rotary movement. Its first cost was estimated at 6,000 fr., or 6 fr. 60 centimes, the stored hectolitre. For smaller apparatus, the inventor raised it to 7 fr., or 7 fr. 50, per hect. (or about 16s. 5d. to 17s. 7d. per quarter). This method has had several imitators, who have, however, thought proper to modify its arrangements. Such is the granary called *Grand Conservateur*, patented the 2nd of April, 1846, in the name of a Polish priest, M. Kalinowski, and which is composed of several series of cylinders of overlapping plates, each rotating, and capable of containing 20 hect. of corn (6 quarters, 7 bushels). The machine of M. Gaillard, junr., (June, 1848,) is formed in like manner, of a cylinder or rotary prism, which the author calls *conservateur aërifère mobile*. Such is the patent demanded the 29th of September, 1849, by M. Pranx, a farmer at Lenet, (Cher.) for an apparatus which he calls aërial and moveable granary, intended for the preservation of corn and the destruction of moths and weevils, and which consists of portable open chests, or large hoppers divided into compartments, and heated to 35° or 40° .

We do not deem it necessary to mention other apparatus, which, either by their ill construction, or by their size or arrangements, are wholly useless in an industrial point of view.

We shall terminate this historical sketch of the methods of preservation of corn, by referring to the rewards accorded by the Academy of Sciences to those who have for some time past been occupied with the question of the destruction of weevils and corn moths (*alucites*).

Dr. Herpin, who received a gold medal from the Central Agricultural Society, employs an instrument resembling a fiddle-stick, which he calls insect crusher, and which moves with a very high velocity.

M. Doyère, Inspector of the Agronomical Institution of Versailles, has proposed three modes, which he considers extremely effectual:

1st. The heating of the corn to a temperature of 55° to 65° centigrade (131° to 149° Fahr.); this heating was executed by the inventor himself in a moveable cylinder, furnished inside with sheet-iron spirals, like the Archimedean screws used for drainage.

2nd. The destruction of insects from the shock produced by a machine he calls *moth-killer* (*tue-teigne*), which is in fact a kind of winnowing machine, working at a very high velocity.

3rd. Close stowage after suitable kiln-drying of the corn.

ART. IV.—*Bulletin of Industrial Statistics.*

IN No. II., Vol. I. of this Journal, we gave a short resumé of the commerce of Belgium, its coal mining, beet sugar manufacture, and the statistics of its railways; we then promised to complete it by giving some account of its manufacturing industry. This promise we shall now fulfil, so far as reliable documents, which are unfortunately not very perfect upon this subject, will permit. We cannot always bring down the statistics to the present year, and in many cases there are no data of a later date than 1846. In all published statistics there are always numerous contradictions, which are not easily reconciled; no doubt, some will also be found in what we have given and shall give; in such cases all we can say is, that we have the choice of what appeared to be the most accurate numbers.

MANUFACTURING INDUSTRY OF BELGIUM.

Linen Industry.—The chief seat of the linen manufacture is in the two Flanders, and derives its raw material from the produce of the soil; the cultivation of flax and hemp places at the disposition of manufacturers about 12,000,000 of kilogrammes of raw flax. The annual exportations of linen yarn only amounts to 1,429,699 kilogrammes, value 4,673,600 francs, and 2,139,133 kilogrammes of woven tissues of flax and hemp, value 10,298,410 francs. In 1846 the linen industry employed 96,617 spindles, and 60,023 persons, of whom 18,563 were men, 7,348 were women, 3,852 were boys, and 20,193 were girls, exclusive of persons who join the preparation of flax and the manufacture of linen fabrics with agriculture. The average wages was then estimated at 80 centimes per day for men, 48 centimes for women, 40 centimes for boys, and 38 for girls. In 1850 36 steam engines, representing 1,169 horse power, were employed in flax spinning. For several years the linen industry was in a very backward condition, and had lost ground in all the markets of the world, but it is again making progress, and about 105,000 spindles are supposed to be now engaged in the spinning of yarn.

Cotton Industry.—The chief seat of the cotton manufacture is the province of East Flanders, especially the cities of Ghent and St. Nicolas; after these come

Nivelles, Brussels, and Soignies. Although a large part of the cotton fabrics is woven by power, certain fabrics are still objects of domestic manufacture. The articles manufactured are of the commoner sorts, which find a certain market; the print works, although not numerous, are not inferior to those of any other country. 6,685,060 kilogrammes of raw cotton are annually employed, value 9,608,805 francs; there are exported 269,819 kilogrammes of cotton yarns and 922,553 kilogrammes of cotton fabrics, valued together at 6,354,400 francs, whilst the imports of cotton yarn and fabrics is estimated at 2,831,200 francs. In 1846 the spinning of yarn employed 379,610 spindles, and gave permanent employment to 14,680 persons, of whom 7,552 were men, 3,129 women, 2,494 boys, and 1,305 girls. The average wages of the men was estimated 1 franc 55 centimes; 1 franc .08 centimes for women; 46 centimes for boys, and 50 centimes for girls. Since then the manufacture of cotton has considerably increased, and in 1850 employed 150 steam engines, representing 1,994 horse power, whilst the exports in the same year rose to 12,658,000 francs, and have been steadily increasing since.

Woollen Industry.—This branch of manufacture has been remarkably developed of late years, not only as regards extent, but also as to quality, and by the introduction of several new branches, especially of mixed fabrics. The chief seat of the manufacture is at Verviers, and the villages and surrounding rural districts. The annual produce of indigenous wool is estimated at 1,350,000 kilogrammes, of which 411,338 kilogrammes, or about one-third, is exported, the remainder being chiefly employed in the manufacture of hats and blankets. The import of fine clothing and other wools for the manufacture of merinos, flannels, &c., amounts to 3,916,675 kilogrammes, value 15,670,600 francs; 38,735 kilogrammes of woollen yarn, value 455,400 francs; 714,068 kilogrammes of cloth, value 12,853,000 francs; and 54,775 kilogrammes of woollen fabrics of all kinds, value 806,200 francs, or together, 14,114,600 francs, are annually exported. The import of similar articles being 8,781,600 francs. In 1846, 130,000 spindles and 5,500 looms were employed in woollen factories, and gave employment to 18,153 persons, of whom 10,134 were men, 4,686 women, 2,076 boys, and 1,257 girls. These numbers are exclusive of all those working at home. The average wages was 1 franc 62 cents. for the men, 81 centimes for women, 58 centimes for boys of 16 years and under, and 56 centimes for girls. In 1850, 175 steam engines were employed in the woollen industry, representing 1,863 horse power, and about 120 turbines and other water-wheels, whilst the export had risen to 19,271,000 francs—worth of all kinds of woollen tissues.

Silk Industry.—This branch of industry, formerly one of the most flourishing of Flanders, is now very unimportant in Belgium, the total import of raw silk in 1850 being only about 22,723 kilogrammes, value 1,205,000 francs. The exports of silk thread are 3,665 kilogrammes, value 318,000 francs, and of silk fabrics 2,419 kilogrammes, value 279,000 francs. The imports during the same period being 7,305 kilogrammes of thread, and 81,854 kilogrammes of silk fabrics, value together, 10,148,000 francs. Antwerp is the chief seat of the silk manufacture, and enjoys considerable repute for the beauty of its fabrics. The number of persons employed in 1846 in the silk manufacture was 655, of which 380 were men, 38 women, 208 boys, and 29 girls; the wages of the men being, on an average, 1 franc 25 centimes, of the women, 94 centimes, of the boys, 38, and of the girls 69.

Millinery, Ribbons, and Lace and Friage, &c.—These branches of industry occupied in 1846, 3,010 persons, of whom 1,497 were men, 675 women, 501 boys, and 337 girls; whose average wages were for men, 1 fr. 30 cents., the women, 61 cents., the boys, 38, and the girls, 36 centimes. Since then the number of persons employed has considerably increased. The export of millinery amounts to 46,019 kilogrammes, value 420,800 francs, the import being 14,481 kilogrammes, value 234,400 francs. The ribbon manufacture, one of the most ancient in the kingdom, has only recently begun to recover from a state of almost complete extinction. The annual export is 4,166 kilogrammes, value 47,600 fr. The lace manufacture has greatly progressed since 1841, the annual export is, however, still only about 36,800 francs, while the import of lace, especially from France, amounts to 667,400 francs.

Hats, and Articles of Wearing Apparel.—In 1846, the number of persons employed in factories engaged in this branch of trade, was 11,057, of whom 5,817 were men, 2,641 were women, 1,352 boys, and 1,247 girls; the wages of the men by an average, 1 franc 14 centimes, of the women, 64 centimes, of the boys, 34, and of the girls, 33 centimes. The value of the exports is about 1,132,000 francs, and of the imports of the same articles, 1,199,000 francs.

Breweries.—In 1850, there were 2,899 breweries in Belgium, and in 1846, the number of persons employed in this branch of manufacture was 6,766, of whom 6,425 were men, 205 were women, 121 boys, and 15 girls.

Distilleries.—In 1840, there were 665 distilleries in Belgium; in 1850, there were 587 in activity, which produced about 266,000 hectolitres of gin, or 5,852,000 gallons, the export in the same year being 9,279 hectolitres, or 204,138 gallons. In 1846, 1,647 persons were employed in distillation, of whom 1,484 were men, 130 women, 27 boys, and 6 girls. The breweries and distilleries had in 1850, 115 steam engines, of 570 total horse power.

Salt Refineries.—In 1850, there were 318 salt refineries in activity. In 1846, there were employed in this branch of trade, 495 persons, of whom 475 were men, 8 women, and 11 boys and 1 girl.

Sugar Refineries and Beet Sugar Factories.—In 1850, there were 50 sugar refineries, of which 26 were in the province of Antwerp alone, which produced about 15,000 tons of refined sugar, of which more than 10,000 were exported. In 1850, there were 28 beet sugar factories in Belgium, of which 16 were in the province of Hainaut; since then the production has doubled, and at present there are more than 50 in activity. In 1846, the whole sugar industry employed, exclusive of those engaged in the cultivation of beet, 4,190 persons, of whom 2,448 were men, 660 women, 716 boys, and 366 girls. In 1850, 67 steam engines, equal to a force of 641 horses, were employed in this branch of trade.

Fire-Arms.—The centre of this manufacture is at Liege, where 432,347 gun or pistol barrels were proved in 1850. In 1851 and 1852, the export of fire-arms was estimated at £215,857.

Nails.—This branch of trade is of considerable and increasing importance, the export alone amounting to about 9,000 tons annually. In 1846, the number of persons engaged in this manufacture was 6,786, who, however, only work in winter, being engaged in summer in agriculture.

Machines.—The construction of machines is a growing trade in Belgium, having progressed within the last few years more, perhaps, than any other branch of industry. In 1846, the number of persons employed being 4,761; and in 1850, 118 steam engines, representing a force of 1,170 horse power, were employed.

Paper.—In 1846, 2,169 persons were employed in the manufacture of paper, of whom 867 were men, 883 women, 243 boys, and 176 girls. In 1850, there were 75 turbines and other water wheels, and 37 steam engines, representing 541 horse power, employed in the Belgian paper mills.

Printing.—In 1846, the number of persons employed in printing, was 2,026, of whom 1,649 were men, 9 women, and 368 boys. Since then the trade has been stationary to a great extent, and must be now diminishing, as the piracy of copy-right has been suppressed.

Quarries of Marble and Slate, and Works in those Materials.—There is a very considerable trade in marbles in Belgium. In 1846, 7,892 persons were employed permanently in connexion with these branches of trade, of whom 6,699 were men, 286 women, 870 boys, and 37 girls. In 1850, 70 steam engines, representing a force of 1,044 horse-power, were employed in those manufactures.

Bricks.—This trade has sprung up almost within the last fifteen years, and is becoming of great importance already. In 1846, 8,203 persons were employed in it, of whom 5,494 were men, 619 women, 1,578 boys, and 512 girls.

Porcelain and Earthenware.—Since the discovery of Kaolin, in the neighbourhood of Huy and Nivelles, and in the province of Namur, the manufacture of porcelain has been developed, and several large factories have been erected. In the same measure that the manufacture of porcelain has progressed, that of the old enamelled earthenware has declined, and is now only used by the poorer classes. In 1846, the number of persons permanently employed in the manufacture of all kinds of pottery was 1,573, of whom 1,189 were men, 63 women, 284 boys, and 37 girls.

Manufacture of Glass.—In 1850, there were 35 glass-houses in activity in Belgium, of which 30 were in the province of Hainaut alone; they employed 16 steam engines, of a total force of 287 horses. In 1841, the Belgian glass-houses produced 20,000,000 of square feet of glass, and in 1847, 32,000,000 of square feet. The annual export of window glass is now about 15,000 to 16,000 tons. In 1840, the factory Sainte Marie-d'Oignies, in Hainaut, was established for the manufacture of plate glass, and now produces between 30,000 and 40,000 square feet of plate glass, of such quality as to compete with the best French. The export of plate glass is now worth about £50,000 annually. The export of cast, blown, and cut flint glass, amounts to between 1,300 and 1,400 tons. In 1846, 3,683 persons were employed in the manufacture of glass, of whom 2,707 were men, and 318 women, 539 boys, and 119 girls.

The glass manufacture is, perhaps, the most successful, as it is one of the most important manufactures of Belgium.

Miscellaneous Manufactures.—Besides the manufactures above enumerated there are many others of minor importance, but which contribute as much to the general property of the country: among them we may mention—753 tobacco manufactories, which employed in 1846, 2,509 persons; 877 tanneries, employing 2,144 persons; 906 oil mills, with 1,956 work-people; 443 chicory factories, and 1,808 work-people; 540 dying establishments, and 1,370 work-people; 591 rope factories; 15 carpet factories, with 763 workers; 179 soap factories, and 410 workers; 12 pin factories, and 263 workers; 97 starch factories, and 109 workers; 12 potatoe starch factories, and 103 workers; and 6 type foundries, with 78 workmen.

In our next Number we will complete the industrial statistics of Belgium, and, if possible, give at the same time, a detailed account of all the measures which have been taken to revive and encourage the manufactures of Belgium, and their application to the somewhat similar circumstances of Ireland.

JOURNAL OF SOCIAL PROGRESS.

ART. I.—Report of the Committee of Social Economy upon the construction of a Working-Men's City at Mulhausen: presented by DR. PENOT, at the sitting of the 30th Nov. 1853.—Translated from the *Bulletin de la Société Industrielle de Mulhouse*; No. 124, April, 1854.

[We believe we shall be doing good service to the cause of the working classes by bringing under the notice of our readers the following account of the successful realization of a Working-man's City at Mulhausen, in Alsace.]

GENTLEMEN,—You have referred it to your Committee of Social Economy to examine and report on a notice by our honourable colleague, Mr. Zickel, upon the construction of the Workmen's City erected at Mulhausen within the last few months. It is certain that no subject could possess greater or more legitimate interest in the eyes of the Industrial Society, occupied as it has already been, so often and so earnestly, with the prosperity of the working classes. Accordingly, your Committee has examined, with all the attention which it deserved, the work submitted to them—

work designed to make the public acquainted with the constitution of the Society, which has undertaken this vast and useful enterprise; the object, elevated as it is, which that Society has proposed to itself; the powerful encouragement which the munificence of the Imperial Government has accorded to it; and, finally, the actual state of the works which have been the result. The Committee has observed, in placing itself in communication with the administrative council of the Mulhausen Workmen's Cities Society, that certain parts of M. Zickel's notice required modification, because that notice no longer represents the actual state of things at this moment, and besides that, it would be necessary to add to it many details, the importance of which you will readily appreciate, and which could not have been within the knowledge of our colleague at the time when he made his communication to the Society.

It has also appeared to the Committee that it would be more convenient to recast entirely the notice submitted to its consideration, than to complete it by a report pointing out the necessary corrections and additions to be made in it. They believe that the work to be submitted to you on their part will thus be the gainer in order, in precision, and in clearness; and it is in conformity with this decision of the Committee, that the Report has been prepared which I have the honour to present to you this day, and which, in part at least, is little other than an exact reproduction of M. Zickel's notice.

Let me go back, in the first place, gentlemen, to the origin of the fair enterprise with which we have to occupy your attention, and to recall to your minds the initiatory part taken by the Industrial Society, faithful in this to the liberal spirit of its institution. Inspired by the examples given in Paris by Prince Louis Napoleon, and in London by Prince Albert, the Society resolved to apply itself, in its turn, to the condition of the lodgings of the working classes in our city; and it commissioned its Committee of Social Economy to prepare a plan of dealing with this subject. The Committee, I need not say, has devoted all the care and zeal of which it is capable, to the accomplishment of the useful mission which you have given it in charge; and, on the 30th June, 1852, I had the honour to present to you, in its name, a Report presenting the results of its deliberations during very many sittings.

It would be superfluous to return to-day to what we then said with reference to the necessity of constructing new houses for the numerous workmen of our city, whose habitations, although already superior to those which they occupied twenty years ago, leave still much to be desired in very many respects. However, I believe it may be useful to recall the conditions under which the Committee insisted that the new buildings should be erected, and which conditions have been adopted by the Society which undertook to found at Mulhausen the city for the working classes, which we see built to-day in one of our suburbs.

"With respect to the habitations of the working classes," said the Report, "we find two very different systems in practice. The first of these consists in the erection of vast edifices, of great barracks, where a more or less considerable number of family establishments may be brought together. In the second, the several habitations are almost isolated; that is to say,

that the number of family establishments united under the same roof hardly exceeds two or three. The larger edifices offer this advantage, that the price of the ground site and the cost of construction being less considerable, we are able to exact a less amount of rent for the lodgings they afford; but they are, on the other hand, subject to inconveniences of so grave a nature, that the Committee has unanimously repudiated the principle of these buildings. We have recognized it as clear that the assemblage of a great number of families, accumulated in one and the same house, ought to be avoided as much as possible. It is rarely that such lodgers, strangers to one another as they are, live in perfect cordiality. The occasions of recrimination and dispute are but too frequent, and everything invites almost inevitable discussions, which are renewed again and again without ceasing. It is evident besides, how much morals may suffer from this too intimate neighbourhood of families; and this capital consideration would be sufficient of itself alone to make us condemn the larger buildings. . . .

"Isolated lodgings are greatly preferable: in them every family lives alone, or nearly alone. The occasions of mischief are there less frequent; there the watchful care of young people becomes more easy; there disputes are almost unknown; there also cleanliness is better maintained, because the responsibility of each occupant is there more direct and more complete. It is therefore in favor of these habitations that the Committee has decided."

"The convenience and cleanliness of a lodging exert a greater influence than may at first be supposed upon the morality and well-being of a family. A man who finds, on his return home in the evening, only a miserable garret, dirty and disordered, where he breathes a nauseous and unwholesome atmosphere, cannot be happy there, and he flies from such a home to pass as much of his time as he can at the cabaret or pot-house. Thus he becomes by degrees a stranger to his family, and he soon contracts habits of expense which that family feels but too acutely, habits which lead almost always to misery and want. If, on the other hand, we can offer to such a man a cleanly and smiling home; if we give to each a little garden where he can find, in the midst of his own, some agreeable and useful occupation; where, in waiting for the modest harvest of his little labour, he will learn to appreciate, at its just value, that instinct of property which Providence has implanted in all of us; shall we not have resolved satisfactorily one of the most important problems of social economy?—Shall we not have contributed to draw closer the sacred bonds of family life?—Shall we not have rendered a true service to the working classes, and to all society itself?"

At the same meeting in which the Committee of Social Economy presented their Report on the necessity of constructing lodgings for the use of the numerous working-men of your city, we were happy to hear M. Jean Dollfus announce (whose intelligent and active philanthropy was so well known to us all) that he proposed to construct at his own expense, and after plans already submitted to him by our colleague, the architect, M. Muller, a house which might serve hereafter, when it should be perfected according to need, as a model of such modifications as experience should have suggested as useful.

You remember, gentlemen, that in order to make its idea better understood, the Committee caused its report to be followed by plans of some model houses which it meant to present to you as but a first specimen of buildings to be erected. The Committee has then seen, with pleasure, that the preference has been given to the plan of M. Muller, which it believes to be more proper for the attainment of the desired end, than that which it had presented itself, and which it was so far from regarding as conclusive, that it said in concluding: "Always, as it is possible that according as the first model houses are constructed some improvement may be made in the plans which we offer to-day, the Committee reserves to itself the power of communicating to you, at another time, another plan, if there should be any occasion for it."

In performance of the promise which he made before you, and before putting in execution, with the generous assistance of some of our fellow citizens and the co-operation of government, the vast project which he had conceived, M. Jean Dollfus caused to be erected at the extremity of the village of Dornach, and under the able direction of our colleague, the architect, M. Muller, four houses, by way of experiment; in order that after having taken the advice of competent persons, and particularly of the working men themselves for whom they were destined, it might be better seen how far they would realize the idea of the projectors. It is in fact after making this sort of experiment, which has developed the utility of several alterations in the plan, that those designs have been adopted, which are at this moment carried out in the Working-men's City.

Thanks to the laudable initiative of M. Jean Dollfus, and to the powerful assistance of the imperial government, which displays so active an interest in improving the condition of the masses hitherto so little thought of, we have seen established in our town, under the title of *Société Mulhousienne des cités ouvrières*, (Mulhausen Society of Working men's Cities,) an association which proposes to "construct one or more of these cities, according as the necessity for them may be recognized. The original capital of this society (which may be subsequently increased) has been fixed, in the first place, at 300,000 francs,* [£12,000,] to which the

* The capital of 300,000 fr. [£12,000] is divided into 60 shares of 5,000 fr. [£200] each, which are thus distributed among twelve original shareholders:—

M. Jean Dollfus, senior	...	...	...	35 shares.
M. Mathieu Dollfus	...	...	...	10 "
M. J. Koechlin-Schlumberger (Mayor)	...	...	...	2 "
M. Jean Zuber	...	...	...	2 "
M. Eugel-Dollfus	...	...	...	2 "
MM. Steinbach, Koechlin, & Co.	...	...	...	2 "
MM. Schwartz & Huguenin	...	...	...	2 "
M. Daniel Koechlin-Schouch	...	...	...	1 "
M. Nicolas Koechlin	...	...	...	1 "
M. Frederic Zuber	1 "
MM. Koechlin-Dollfus & Brother	1 "
MM. Schwartz, Trapp, & Co.	1 "

Total	60 shares.
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government, in its munificence, has thought proper to add a sum of 150,000 francs, [£6,000,] so as to contribute to the extent of one-third to this honourable enterprise, as it has already contributed, in the same proportion, to the erection of the washing establishments and public baths, which already render such valuable services to many of the working classes of our town.

"The shareholders," says the deed of the society, "having in view only the well being of the working men, and having no other object but to lodge them in a manner more healthy and more comfortable, as well as to facilitate the acquisition by them at mere first cost price, therefore at the cheapest possible rate, of the houses and their appurtenances about to be established by the society, each share only entitles the holder to, and will never entitle him to more than, an interest of 4 per cent., and the repayment of his subscribed capital. The shareholders resign all right to any fine or further benefit whatever."

The deed of the society was signed the 10th June, 1853, and already on the 27th of the same month, M. Jean Dollfus submitted to the shareholders a general plan, as well as the plans in details of the first Working-man's City to be established. A few days after, the 20th July, the works were commenced upon the site chosen. According to the plans proposed by M. Muller, this first city will occupy a space of 8 hectares [about 19 acres 3 roods]. One principal street intersects its whole length; eight or ten others, of less extent, divide the different sections. The principal street is 8 metres [26 feet 2 inches] in breadth in the clear; the lesser streets 5 metres, [16 ft. 4 in.,] with foot ways of $1\frac{1}{2}$ metres [4 ft. 11 in.] on each side, and paved gutters for draining off the water. The streets, as well as the foot ways, are all macadamized; they are lighted with gas, at the expense and under the care of the town, (of Mulhausen,) and they are connected with a drain of masonry which carries off water of every description from the houses.

By a happy disposition of M. Muller's plan, each group of houses (containing four) finds itself set in the midst of a garden enclosed by a transparent or open fence, and the entire surface of the garden dividing itself into four equal parts; a quarter of the land is appropriated to each house. Thus this first Working-man's City, in placing the inhabitants under conditions the most favourable to health, as to ventilation and the free access of pure air, will present the most smiling aspect, of which the plan which accompanies the report will give some idea.*

For the detailed plans of the different classes of houses of which the Working-man's City is to be composed, the architect, at the same time that he has sought to give each habitation its proper share of advantages and every desirable convenience, felt bound to confine himself within strict

* It has not been thought necessary to reproduce here the plans and sections of the houses erected at Mulhausen, because the nature and design of these is little likely to be of use in suggesting the plan of such buildings among us. And for the rest, the Mulhausen plans are sufficiently intelligible from the text of the Report.

limits, in order to fulfil that essential point of the programme, *to construct houses for working-men at the cheapest possible rate.* Three classes of houses have, therefore, been admitted, all consisting of a single story above the ground floor, namely:—

1st Class. Group of four houses, distinct and separate, but constructed under the same roof, placed in the midst of four gardens, and each of which houses is composed of: a cellar under ground; on the ground floor a kitchen, and a large apartment with an alcove, which may be divided into a sitting room and an alcoved bed room; on the upper story, three rooms, besides a proper necessary fitted with an air chimney, to secure freedom from unwholesome smells; above the upper story a garret able to contain a supply of 8 *sècles* (2 *cordes*) of fire wood, [or say five chaldrons of coals,] a quantity rarely possessed at one time by a working-man's family.

2nd Class. Similar group of four houses under the same roof. The same internal disposition as for the 1st Class; but the cellar is exchanged for a small store cut to a yard in depth, and large enough to contain just the ordinary provisions of a family.

3rd Class. Series of houses upon the same line, and placed in juxtaposition, back to back, under the same roof, forming each a separate residence with a stripe of garden, and having the same internal distribution as the first class, except only that they have one story less, the other being replaced by a garret in the sloping roof, capable of answering a double purpose.

The hundred houses constructed this year are divided into 48 of the 1st Class, 32 of the 2nd; and 20 of the 3rd Class. The price of *sale* of these houses has been thus fixed, according to the information which has been furnished the Committee:—

1st Class: average price,	2,800 fr. [£112.]
namely:	
24 houses facing the South,.....	2,900 fr. [£116.]
24 houses facing the North,.....	2,700 fr. [£108.]
2nd Class: average price,	2,500 fr. [£100.]
namely:	
16 houses facing South,.....	2,575 fr. [£103.]
16 houses facing North,.....	2,425 fr. [£97.]
3rd Class: 8 houses with angles, having light on both sides,	2,150 fr. [£86.]
12 houses having but one light,.....	1,850 fr. [£74.]

To these prices must be also added various rights of different kinds, amounting to from 9 to 10½ per cent., in addition to the sums named. In order to give the greatest facility to purchasers, the Society makes an advance of these rights, so that the purchaser has to pay in ready money but 300 to 500 francs [£12 to £20], according to the class of house he desires to buy. He has then to pay the remainder of his purchase money by monthly instalments of from 20 to 30 francs [16s. to £1. 4s.], in such a manner as that the cost of the deed and the payment of *one-half* the capital, inclusive of the interest due to the different parties, regulated and discounted at the end of each year, may be effectuated within about five years, or even sooner, if possible.

As to the other half of the purchase money, the purchaser will have to pay interest for it at 5 per cent. to the *Société du Crédit foncier* de France*, until the whole be paid off. For this purpose the Society of Mulhausen made arrangements with the *Crédit foncier* so as to borrow, in its own name, one-half the price of the hundred houses constructed this year, handing over to it the contracts made with purchasers according as they are completed. According to this arrangement, the purchaser will become a debtor to the *Crédit foncier* for half the value of his purchase, and will pay interest to that society until the full re-payment of the debt.

In order to facilitate this combination, so favourable to the purchaser, the Government has consented to allow payment of the mortgage to the *Crédit foncier* in precedence of and before the mortgage which the government is to take upon the entire of the buildings as a guarantee for their construction according to the conditions approved by it, and in consideration of which it has thought fit to bear one-third of the whole expense.

In order to prevent the houses of the City from falling into the hands of speculators, who would buy them only to let again at the most profitable rent, the Society of Mulhausen, which, in the first instance, selects the persons with whom it treats, has taken care to introduce this condition into each contract, that the buyer shall not sell or sublet for ten years, without the approbation of the Administrative Council of the Society, which reserves to itself the right of approving of new proprietors or lodgers. It is easily conceivable, that but for this wise precaution the object proposed in creating the Workingman's City might have wholly failed; and the generous intentions of the Government and of the shareholders would but have served, perhaps, to secure heavy interests to a few capitalists, who might have become proprietors of a great part of the houses erected.

Again, for the sake of order and morality, it is forbidden that two families should occupy, in common, the same house. Lastly, the contract of purchase contains besides, some conditions obliging every purchaser to take the necessary care of his holding, and to attend to the uniformity of the general plan, in order to preserve to every part of the city its full value, and to the whole its proper effect of view. Thus he is required to keep in good repair, cultivation, and fast enclosure, the houses, gardens, and palisading; to preserve the uniform plan adopted for the exterior painting of the houses, &c.

Upon these conditions, and at the prices above indicated, about one quarter of all the houses built this year have already been sold; and it is probable that a still greater number of purchasers would have appeared if a greater number of houses could have been finished before the beginning of the winter; and if the thick fogs which for some weeks have filled the air, succeeding as they did to long continued rains, had not hindered from drying some of the houses already completed, and whose actual state of

* The *Société du Crédit Foncier de France* is an association lately established in that country under the sanction (though not at the expense or with the guarantee) of the Imperial Government, for making loans on land, for the purposes of building and improvement, upon the principle of the German land banks.

damp makes it impossible to inhabit them as yet. This eagerness of some of the working-men contains an excellent presage of the future. It encourages us to hope, that in spring the number of purchasers will be increased in remarkable proportion; and as soon as the first hundred houses built shall be in great part sold, the Society of Mulhausen will cause to be commenced the construction of two hundred others, which will complete the first Workingman's City.

If, as we may hope, these first three hundred houses find purchasers, the Society of Mulhausen, counting always on the sympathy and assistance of the Government, proposes to make a very great extension in its useful enterprize, by means of a combination which it seems possible to realize. Government having already accorded 150,000 francs [£6,000], it may be hoped that it would grant an equal sum again to render possible the accomplishment of the projected city.

Let it be then, on the part of the State, in all,...	300,000 fr. [£12,000.]
Half the whole value of the buildings borrowed from the <i>Credit foncier</i> ,.....	350,000 fr. [£14,000.]
Add to these two sums the original capital of,...	300,000 fr. [£12,000.]

We obtain a total of,..... 950,000 fr. [£38,000.]

With this capital of nearly a million of francs [£40,000] we could lodge very comfortably a great part of the working population, and we could offer that population advantages which nothing but a vast collective system can ever realize. Thus the assistance already accorded by Government is up to the present time destined to cover the expenses caused by the construction of the streets, the footpaths, the public square, the common sewers, the wells, the baths, and washhouse, &c.; an arrangement which allows us to exclude these general expenses from the calculation of the value of the houses; but if the City comes to realize all the extension contemplated for it, we may see erected there a *salle d'asile*,* at present not so necessary because there is already one in the neighbourhood; a school and a gymnasium for the children of different sexes; a reading-room, and select library; a bakery, a butcher's establishment, a grocery, a common kitchen like that already in existence on the Dornach road, &c. These last institutions, placed under the direct surveillance of committees appointed by the inhabitants of the City, might supply their productions at reduced prices, and thus procure to the working-man the means of living at the cheapest possible rate.

* In almost every industrial city and town in France the families of the working classes are provided with proper places in which the children may be left by their mothers while engaged in their own daily work. They are of three classes; the *crèches*, consisting of large rooms where children under two years old are kept by nurses and proper female attendants, assisted and superintended by benevolent ladies of the town; a second class, called *salles d'asile*, for children a little older, where the walls are hung with various objects, religious and others, proper for educating them by means of the eye; and lastly, the ordinary primary schools. The *salles d'asile* correspond with, and are we believe imitations of, the infant schools of England; but the *crèches* are, so far as we are aware, developments of the original idea, peculiar to France. We purpose giving an account of these establishments in a future number.

You perceive, gentlemen, how large and extended is the plan proposed by the Mulhausen Society of Working-men's Cities, and how great a gain its accomplishment would secure to our population. The Committee of Social Economy reserves it to itself to make you a new report at a later period upon the effects, moral as well as physical, which the establishment of the Working-men's City may be able to produce; but in the hope that other industrial towns will desire to imitate ours of Mulhausen, and in order to furnish them with suggestions useful for their consideration, we propose to you to print at once the present report, adding to it the three plans now brought up in connection with it, in order to give a general view of the city in construction, and to make intelligible the arrangement adopted in the houses of the first class.

In conclusion, gentlemen, it remains for us in your name to fulfil a duty, when we offer the lively thanks of the Industrial Society to those of our fellow-citizens who have founded among us the first Working-men's City, and to that generous Government which has so well understood that one of the noblest missions which Providence has confided to rulers, is to ameliorate without ceasing the condition of the people, by teaching everywhere, by provident institutions, how much of happiness and contentment order and economy may procure for man in this world.

ART. II.—*Industrial Property.* (Translated from *Le Genie Industriel*, vol. 8, No. 47. Paris, 1854.) The Bill to regulate Patents in the Sardinian States (Piedmont).

[We shall find an early opportunity of directing attention to the subject of these observations of the *Genie Industriel*, and of the Piedmontese Bill, and the Belgian Law which follow them, namely, the Law of Patents and Copyright; in the mean time, our readers will be glad to become acquainted with the text of these remarkable measures of wise and simple legislation, which indeed form the best introduction to a practical consideration of the subject among ourselves.]

THE legislation of Piedmont upon Industrial property is altogether defective. The right of the Inventor, under the Piedmontese law, is made subordinate to considerations of every kind of interest, and thus becomes inaccessible to the majority. It is, therefore, with great satisfaction, that we observe that this country is on the eve of a radical reform, which the promulgation of the new law of Belgium seems to have inspired. [See NOTE, page 42.]

We reprint a Bill to regulate Patents, which has just been communicated to us (*Genie Industriel*), and which will shortly occupy the attention of the Legislature at Turin. This Bill, though short, presents some remarkable features, which do not exist in any existing industrial legislation; among others, the assimilation as to its duration of the property in works of the mind, (Copyright,) works of Art and of Industry, to ordinary pro-

perty; that is to say, the accordance of an unlimited duration to the former.

BILL.

ART. 1. The property in works of the mind, (Copyright,) of Art, and of Industry, is assimilated to ordinary property.

All the codes, laws, and regulations which protect existing property are applicable to the protection of this new property also, and it enjoys the same rights, and remains equally subject to expropriation, and to all the laws in force with reference to public security, health, and morality.

ART. 2. Every invention, combination, or application capable of becoming the object of an industrial or commercial enterprise, and which has not yet been publicly put in operation in the country, at the moment of application, shall be considered as property capable of assignment, and of acquiring a Patent, subject to the *droit des tiers*.

ART. 3. The Patent is accorded without guarantee or hindrance to the first person who demands it, upon his depositing at the prefectures, or with the diplomatic agents abroad, the description of the object, the machine, or the process, whatever be its origin or nature, with which he desires to enrich the industry or commerce of the country.

ART. 4. No Patent is legally operative except for that which the patentee has clearly explained in his description or specification, and defined as far as, and wherever possible, by plans, in which the new portion of the invention or application shall be expressed in colours.

ART. 5. The tax payable upon depositing specifications is fixed at:—

10 fr. [8s.] for the first year;

20 fr. [16s.] for the second year;

30 fr. [£1. 4s.] for the third year, and so on, increasing by 10 fr. [8s.] each year, but with power to compound for all such annual payments for the sum of 3000 fr. [£120.]

ART. 6. The amount of the annual tax shall be added to the ordinary annual taxes payable by the patentee, or his representative, and the patent with its privilege shall not be held to cease, save in consequence of a voluntary refusal to pay the tax after the customary notice and demands.

ART. 7. The property of the Patent dates from the moment of depositing the specifications, which may be made in a foreign language, provided only that the claimant must furnish, within six months, a translation and correction, carefully edited, which shall be published in so many words in the course of the year, under the responsibility of the patentee, in the *Moniteur officiel des brevets*. (Official Patents Gazette.)

All the plans must be included in a sheet of 20 to 32 centimètres [about $7\frac{3}{4}$ to $12\frac{1}{2}$ inches.]

Every specification which shall occupy more than one page, in 4to, of the *Moniteur*, and every plate beyond one, shall be published at the expense of the claimant.

ART. 8. Foreign patentees, or their representatives, shall alone be entitled to obtain a Patent during the course of the first year.

ART. 9. All holders of Patents now in force shall be permitted, during

the first year, to place their property under the protection of the new law, by a new deposit of specification, enriched with all the improvements and additions which they shall have been able to make to their discoveries.

All expired and forfeited Patents, publicly used in the country at the date of the present law, are excepted from the operation of this article.

ART. 10. Neither the natural elements, the general principles of science, nor raw materials generally known, can be made the subject of a Patent; but only apparatus, machines, and methods or processes for obtaining from them results, effects, or productions not hitherto obtained in the country.

ART. 11. All holders of Patents are required to affix their name, followed by the word *breveté* [patent] and the year of the patent, upon such productions as they offer for sale.

ART. 12. All the details of execution of the present law shall be determined by ministerial decrees and regulations.

NOTE.—The following are the details of the Belgian law above alluded to, extracted from the June number of the *Genie Industriel*, No. 42, vol. 7. [And see also the *Code général de la propriété industrielle, littéraire, et artistique*, par MM. Etienne Blanc and Alex. Beaume. Paris, Cosse: 1854. Page 605.]

ART. 1. Exclusive and temporary rights will be accorded, under the name of Patent of Invention, of Improvement, of Importation, to every discovery or improvement capable of being dealt with as an object of industry or commerce.

ART. 2. Patents shall be accorded, without previous examination, at the risk and peril of the claimant, without guarantee whether of the reality or of the novelty or merit of the invention, or of the exactness of the specification, and without prejudice to the *droit des tiers*.

ART. 3. The duration of Patents is fixed at 20 years, except in the case provided for by Article 14; it will take effect from the day of the date at which the specification mentioned in Art. 18. shall have been completed.

For each Patent the following annual and progressive tax shall be paid: 1st year, 10 francs; 2nd year, 20 fr.; 3rd year, 30 fr.: and so on to the 20th year, for which the tax shall be 200 fr. [£8.] This tax shall be paid in advance, and shall never in any case be repaid. No tax shall be required for Patents of Improvement when accorded to the holder of the principal Patent.

ART. 4. Patents confer on their possessors or those entitled to them the exclusive right:—

a. To deal with the patented object for their own profit, or cause it to be dealt with by persons authorised by them thereto.

b. To proceed at law against those who shall infringe their rights, whether by the manufacture of products or by the employment of processes included in the Patent, or in having, selling, exposing for sale, or introducing into the Belgian territory one or more counterfeited works.

ART. 5. If the persons prosecuted in virtue of Art. 4. letter b, have acted knowingly, the courts shall decree the confiscation of the goods manufactured in infringement of the Patent, and of the instruments and utensils especially designed for their manufacture, in favour of the Patentee or those deriving from him, or they shall adjudge a sum equal to the price of such goods as may have been already sold.

If the persons prosecuted have acted in good faith, the courts shall forbid them, under the penalties above mentioned, from employing for any commercial purpose the machines and apparatus of manufacture adjudged as counterfeit, and from making any use for any such purpose, of instruments and utensils for the manufacture of the patented objects.

In both cases damages and interest may be adjudged to the Patentee or those deriving under him.

ART. 6. The holders of Patents or those deriving under them may, by the

authority of the President of the Court of First Instance, obtained by proper process, cause to be drawn up, by properly skilled persons, a description of the counterfeited apparatus, machines, and manufactures.

The President may, by the same decree, forbid the persons detaining in their possession the before mentioned objects, to part with them, and may permit the Patentee to appoint a guardian, or even to put the objects themselves under seal.

This decree must be communicated by an officer of the court to the person so charged.

Art. 7. The Patent shall always be annexed to the process, which shall contain the designation of a house in the commune where the description is to take place. The skilled persons named by the President shall be sworn by him before commencing their operations.

Art. 8. The President may oblige the Patentee to make a deposit. In this case the decree of the President shall not be delivered save upon proof of the deposit being actually made. Foreigners must in every case make deposit.

Art. 9. The Patentee may be present at the description, if he be specially authorised thereto by the President of the court.

Art. 10. If the doors be closed or access be refused, the Art. 587 of the Code of Civil Procedure shall be put in force.

Art. 11. A copy of the certificate of description shall be delivered to the person detaining the objects described.

Art. 12. If in the course of eight days the description is not followed by a summons before the tribunal of the district, the decree made under Art. 6, shall *ipso facto* cease to have effect, and the person detaining the objects described may demand the return of the original certificate, and that the patentee be forbidden to make use of its contents or to make it public, all without prejudice to damages and costs.

Art. 13. The courts shall consider proceedings in relation to Patents as summary and urgent in their nature.

Art. 14. The author of a discovery already patented abroad may obtain himself, or those deriving under him, a Patent of Importation in Belgium; the duration of this Patent shall not exceed that of the Patent previously granted abroad for the longest term, nor in any case the limit fixed by Art. 3.

Art. 15. In case of any modification in the object of a discovery, a Patent of Improvement may be obtained which shall terminate at the same time with the original patent.

Wherever the possessor of the new Patent is not the original patentee, he shall not be allowed without the consent of the latter to avail himself of the original discovery; and on the other hand the principal patentee shall not be allowed to make use of the improvement without the consent of the possessor of the new patent.

Art. 16. Patents of Importation and of Improvement shall confer the same rights as Patents of Invention.

Art. 17. Whosoever desires to obtain a Patent shall be bound to deposit under seal, in duplicate, with the *Greffier* of one of the provincial governments of the kingdom, or at the office of the commissariat of an *arrondissement*, following the formalities prescribed by a royal decree, a clear and distinct description in one of the languages used in Belgium, and an exact plan upon a metrical scale of the object of the invention.

No deposit will be received save upon production of a receipt for the payment of the first year of the Patents' tax.

A certificate drawn up gratis by the provincial *greffier*, or by the Commissary of the *arrondissement*, upon a special register, and signed by the claimant, must certify each deposit, entering the day and hour of the delivery of the documents at the office.

Art. 18. The legal date of the invention is proved by the certificate drawn up at the time of depositing the claim of patent.

A duplicate of this certificate shall be delivered free of expense to the depositor.

Art. 19. A decree of the Minister of the Interior certifying the completion of

the prescribed formalities shall be delivered without delay to the depositor, and shall constitute his Patent. This decree shall be inserted by extract in the *Moniteur*.

Art. 20. The description of Patents granted shall be published at full length or in substance at the earliest convenience of the office, in a special collection, three months after the passing of the Patent. When the Patentee shall require the complete publication, or that of an extract furnished by him, such publication shall be made at his expense.

After the same interval the public shall be admitted to learn the description, and copies of them may be obtained on payment of the cost.

Art. 21. Every transmission of Patent-right by deed or will shall be registered at a fixed rate of 10 francs. [8s.]

Art. 22. The Patent shall, *ipso facto*, cease in case of non-payment, within a month of the expiration of the time prescribed, of the tax fixed by Art. 3. Such cessation shall be made public in the *Moniteur*.

Art. 23. The holder of a Patent may work the patent object, or cause it to be worked in Belgium, for one year from the date of working it abroad.

The government may always, by royal decree *motivé*, inserted in the *Moniteur* before the expiration of that time, accord a prorogation to the extent of one year more.

At the expiration of the first year, or of the delay which may have been accorded, the Patent shall be annulled by royal decree.

The amendment shall be also decreed where the Patent, worked abroad, shall have ceased to be worked in Belgium for one year, unless the holder of the Patent shall justify the cause of his inaction.

Art. 24. The Patent shall be declared null by the courts for the following causes:—

a. When it shall be proved that the object patented has been employed, put in practice, or worked by a third party in the kingdom for a commercial object, before the legal date of its invention, its importation, or its improvement.

b. When the Patentee, in the description annexed to his claim, shall have intentionally omitted to mention any part of his secret, or shall have indicated it in an inexact manner.

c. When it shall be proved that the complete specification and exact drawings of the patented object have been produced at a time anterior to the date of the deposit, in a work or collection printed and published, unless, as regards Patents of Importation, this publication be exclusively the effect of a legal process.

Art. 25. A Patent of Invention shall be declared null by the courts where the object for which it shall have been granted has before been practised in Belgium or abroad.

Always if the claimant have the qualification required by Art. 14, his patent may be maintained as a Patent of Importation, according to the terms of the said article.

These dispositions shall be applied, when the case requires it, to Patents of Improvement.

Art. 26. When the nullity or dissolution of a Patent shall be decreed, according to the terms of articles 24 and 25, by judgment or decree having the force of judgment, the annulment of the Patent shall be proclaimed by a royal decree.

Art. 27. Such Patents as shall neither have expired nor been annulled at the time of the publication of the present law, shall continue to be governed by the law in force at the time of their being granted.

Nevertheless it shall be lawful for the holders, within one year from said publication, to make a new demand of Patent, in a form to be determined by a royal decree.

In this case the Patent may continue to run during all the time necessary to complete the duration of twenty years, saving what is contained in Art. 14.

Patents for which the benefit of this provision shall be demanded, shall be governed by the present law: provided always that proceedings commenced before its publication shall be brought to a conclusion according to the former law.

Holders of Patents who shall have paid the entire of the tax formerly payable,

shall, after the expiration of the term of privilege first assigned them, pay the current taxes every other year, according to the regulations of Art. 3.

As to those holders of Patents who have not paid the whole of the tax payable on the acquisition of their original Patents, account will be taken of the sums already paid by them, and their annual payments will be regulated accordingly, in conformity with Art. 3.

[Royal assent, 24 May, 1854.]

NOTICES OF BOOKS.

Introductory Text-Book of Geology.—By DAVID PAGE, F.G.S. William Blackwood & Sons, Edinburgh and London. Pp. 136. Price 1s. 6d.

A good introductory Text-Book of Geology has long been a desideratum. We were therefore very glad to see the announcement of Mr. Page's intention to publish one; and although on receiving it, we cannot say that it exactly comes up to our idea of what a text-book ought to be, or even what we expected Mr. Page to make it, from what we had heard of him, yet we welcome its appearance as calculated to be of use to many students. We are of those who hold that there can hardly be too many introductory and elementary books of this kind, so that none of them actually mislead their readers. It is most useful to have the same facts, and the same sets of ideas, clothed in different language and presented in different lights, since they will thus be best adapted to be received and retained by different minds, or even by the same mind, at different seasons.

For this reason we welcome Mr. Page's little book, and can recommend it to our readers as a compendium of some of the principal facts of Geology, told in plain, simple language, neatly illustrated, and published at a very small cost.

There are, however, a few defects which we hope Mr. Page will have an opportunity of remedying in a second edition; these defects are not of any vital consequence in themselves, individually, but they are injurious, as lessening the student's confidence in the perfect accuracy and trust-worthiness of the book. We do not allude so much to little blunders, such as translating "*fit*" by "*I make*," on page 9, as to errors in geological classification; the use of an antiquated and worn-out nomenclature; and imperfect description of geological facts.

Among the errors in classification we could point to placing the Triassic and Permian groups together, as members of the same system (the New-Red), on pages 38 and 135.

Worn-out nomenclature is exemplified on page 37, where the term Transition is re-introduced into Geology, for the first time these twenty years, to designate a class of rocks interposed between Primary and Secondary, and thus the elements of all sorts of confusion of ideas are put into the student's mind.

Imperfect descriptions of geological facts are still more numerous. We

may instance the account of the Devonian and Carboniferous rocks. An inhabitant of Devonshire, trying to comprehend the structure of his native rocks, would be greatly puzzled by Mr. Page's description of them, which is only adapted to Scotland; and an inhabitant of Derbyshire would be equally confounded by being told that the mountain limestone "occasionally exceeded a hundred feet in thickness." Mr. Page too says nothing of "joints," in his general account of the structure of rocks, but introduces them in his account of the mountain limestone, as if they were peculiar to that, instead of being common to all rocks.

Mr. Page's ideas of igneous rocks, and their relation to the aqueous, are not of the highest class; neither does he define, with sufficient precision, the differences between mineral veins and veins of injection; the nature of metamorphic action, or slaty cleavage; nor the difference between cleavage and foliation.

We do not, moreover, approve of Mr. Page's system of recapitulating his matter at every step. According to our ideas of a text-book, it should stand in no need of such condensation, but should itself be as condensed an abstract of all the facts, and theories, and principles of the science of which it treats, as it was in the power of the writer to give.

Although, therefore, we can recommend Mr. Page's little book to the geological student, as one worthy of perusal, as one giving a tolerable sketch of Geology as it existed a few years ago; we cannot hold it forth as an absolute authority, or to be read alone. To sum up in one word, Mr. Page's little book is a *Text-Book of Geology*; but it is not, in our opinion, the text-book destined to supply the existing and increasing demand for such a work.

Seed Oily Cake; its value and Use in Agricultural Economy. By J. DE COCK KENIFFECK, Flanders, Agriculturist to the Royal Flax Improvement Society of Ireland. Cork: George Purcell & Co. 20, Patrick-street; Dublin: James McGlashan, Sackville-street; Belfast: Greer, High-street. Price 2s. 6d.

ALTHOUGH firm believers in the value of association for effecting certain objects, such, for example, as the diffusion of knowledge or the improvement of agriculture, we must admit, that with one or two exceptions, the principle has as yet been productive of little fruit in Ireland. Our agricultural societies have in almost every instance been managed by small cliques, whose members have about the same connection with farming pursuits as the gentry facetiously called, in the South of Ireland, "sky farmers," and whose beau-ideal of agricultural improvement is an apoplectic pig, and an immense field of big Swedes. That the Irish peasantry should have attached little importance to the views of these "improvers," notwithstanding the annual report of the "highly satisfactory progress made within the last year," and the usual round of conglorification indulged in by the "managers," is not to be wondered at. The agricultural improvement of this class of philanthropists means, the degradation of the small farmer into the mere proletaire, or his complete substitution by an ox.

There is one society, however, to which these remarks do not in any way apply—the “Flax Improvement Society,” which, in furthering the special object for which it was established, has indirectly done more towards the improvement of agriculture in Ireland, in ameliorating the condition of the tenant-farmer class, than all the agricultural societies which have ever existed there, whilst it has elevated the character of the country abroad.

One of the means by which this society sought to effect its objects was, by sending proper persons to the flax districts of the Continent, to acquire on the spot the knowledge of the best management of the flax crop; and to induce competent persons, natives of those districts, to come to Ireland, and assist in spreading such information through the country. The person selected for the latter object was Mr. De Cock Kenifick; and if the Flax Society had done nothing else than be the means of sending him to the South of Ireland, it would have deserved well of the country. During the few years that he has been in Ireland, he has laboured with a singular devotion and enthusiasm in endeavouring to spread information throughout the Southern Counties, especially the County of Cork, upon the growth of flax, and his labours have been successful; for we are confident that the culture of flax is now firmly rooted in the south of Ireland, and requires only that element which is indispensable in any branch of industry, time, to fully develop it.

But Mr. De Cock Kenifick has done more than his mere duty, for seeing, with regret, how a large source of wealth was utterly neglected, in the immense quantity of flax-seed annually lost, he warmly seconded the exhortations of the Flax Society to the farmers, to save the seed of their flax crop; and showed, in a small pamphlet published a couple of years ago, that a profitable field of industry lay open to Irish agriculturists, in the growth of oleaginous seeds, for the production of oil. The development of a manufacture in any country is a slow process, but especially so in one so devoid of manufacturing spirit as many parts of Ireland have been; no great immediate results could therefore have been anticipated from this book, or the active propagandism of the author: nevertheless, he has succeeded, in the course of a few years, in endowing Cork with a new branch of manufacture, the crushing of oil seeds.

It is of little use to manufacture an article not in demand: now, in the crushing of oleaginous seeds, besides the oil, there is produced a residual cake, rich in the flesh-forming elements of food. In other countries this is largely employed to feed cattle, and thousands of tons of it are imported annually into Great Britain from the continent; in Ireland, on the contrary, its use is almost unknown, and hence it is almost useless to encourage the growth of oil seeds or the manufacture of oil here, unless a ready local market be found for the cake. Mr. De Cock Kenifick has clearly understood this, and hence has originated the book whose title we have given above, and which is a necessary complement to the one on the growth of oleaginous seeds.

This book consists of a number of short chapters, embracing the statistics of the growth of oily seeds in Belgium, and the production of oil

cake from them; the value of feeding cattle either on oleaginous seeds or oil cake; the principle upon which oil cake is employed as a food for cattle in Belgium; its use as a direct manure; the result of a number of experiments upon the value of oil cake made by a large agriculturist in Belgium; the adaptation of Ireland for the production and home consumption of oil cake; the past and present position of the British oil manufacture; the comparative value of existing crushing machinery; the adulterations of oil cake and the mode of detecting them; the effect of oil cake feeding upon the quality of winter butter; oil as a civilizing agent in the domestic economy; directions for feeding with oil cake; directions for using it as a manure, and many other valuable remarks.

Further than this we do not intend this month to analyse the book, because our space will not allow us at present to do justice to a subject of such vast importance to this country; in a future number we shall return to it, for we have much to say upon the question generally, and in the mean time we desire to direct the attention of all interested in the agriculture and improvement of Ireland to the two books, which ought to be in the hands of every farmer in the country.

Limited as our space is, we cannot, however, resist the temptation of making one short extract, as affording a striking contrast between the mode in which an enlightened and sympathizing Belgian or Frenchman would view the degradation of our social condition, and the mode in which he would remedy it, and the absurd (when not positively immoral) means which "ameliorators" from the other side of the channel, propose for our civilization.

"Though the greater number of Irish occupiers find the means of providing themselves with fuel on their own holdings, they are very differently situated with regard to the materials for lighting their premises; and when we consider the expense of importing and manufacturing that indispensable commodity of candles from foreign stuff, advanced in price by agencies, and by profits to different sets of merchants, it seems very strange that the use of oil, as a substitute for candles, has not yet made way into Ireland.*

"Want of cheap light is attended with many evils, especially among the poorer classes; indeed to that want the ragged condition of the peasantry of Ireland may in some degree be attributed, as it is chiefly after sunset their leisure could be found to use the needle by the females of the family. In Flanders oil lamps to suit all classes of customers are everywhere attainable, and of sizes varying from those consuming two or those consuming four ounces of oil per winter night; the rate of cost is from under a half-penny to nearly a penny for oil for five hours' consumption.

"Between this and the purchase of candles there is this material difference, that the farmer, instead of laying out money from which the foreign producer derives the benefit, can, by converting a little of his own seed to cake and extracting the oil, save a store of both articles at a very low prime cost. The higher classes in Belgium use oil lamps also, having the oil purified, so that it produces a less annoying smell than that which proceeds even from waste candles; and much taste is displayed in the manufacture of lamps, which in many instances are most magnificent pieces of furniture."

* "The manufacture of candles of all sorts, is one of the most lucrative trades in Ireland.

THE

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ART. I.—*On Watt's Method of Steeping Flax.*

[MR. LEADBETTER, of Belfast, who is joined with Mr. Watt in carrying out his peculiar process of flax steeping, having considered that the article of Mr. MacAdam, "On the Patented System of Steeping the Flax Plant," was of a character to injure the prospects of the process in which he was interested, I at once offered Mr. Watt to publish any communication which he may choose to make relative to the present condition of his process, and the results of his and others' recent experiments. This, which would in any case be but a simple act of justice, I was the more anxious to do, because I had always looked upon Mr. Watt's system as one which, whether successful or not, opened up a completely new field of inquiry and improvement in the process of steeping flax. And as there is abundant room for improvement in the processes hitherto adopted for preparing flax fibre, I think it most desirable that this, one of the most vital questions which could engage our attention in Ireland, should be thoroughly discussed, and an opportunity offered to the advocates and opponents of each system of steeping, to put their opinions upon record in a more complete and permanent manner than could be done in the pages of a newspaper.]

In this spirit, then, I feel great pleasure in presenting to the readers of this Journal the following communication from Mr. Watt, which I recommend to the serious consideration of all interested in the cultivation of flax.

In connexion with this matter, I wish to make a few observations relative to Mr. MacAdam's paper, which was made the subject of a good deal of discussion in the Flax Society, in consequence of Mr. Leadbetter having connected that body with the article in question. It was at my special request that Mr. MacAdam, as a friend, and one who felt interested in the success of this Journal, then just started, wrote the article. I did not apply to him, as Secretary of the Flax Society, to write me an article, and I certainly never entertained the idea that his opinions should necessarily be those of the body whose secretary he was, or that he could thereby compromise that body. I do not think that a man and his office ought to

be confounded; and I certainly would think it strange in my own case, if any opinions which, as an individual, I would consider myself entitled to hold, were considered on that account to be those of an institution in which I may at the time perform certain functions.—ED.]

TO THE EDITOR OF THE JOURNAL OF INDUSTRIAL PROGRESS.

SIR,—I avail myself with pleasure of your kind offer of space in your valuable Journal, and shall be happy to give your readers the results of my experience and observations in flax preparation, and I do so the more readily, as I believe it is a subject which, although affecting me personally, is one of very general interest and importance.

One cannot view the prospects of the flax trade without comparing it in some measure with that of the cotton trade; and it may not be uninteresting to those engaged in any of the several branches of linen manufacture to glance at the relations the flax and cotton plants bear to each other in their growth and preparation, in order to see which has at present the advantage in those early stages.

In the production of cotton in the United States, we have a class of intelligent men, who have capital and every other appliance necessary for the purpose producing this article, not only at the cheapest possible rate, but also of sending it into market in a business-like shape, ready in every way for the use of spinners. On the other hand, the production of flax in Ireland, and I may add in almost every other country, is for the most part in the hands of a very unskilled and ignorant portion of the community; and as a natural consequence, the processes are exceedingly crude and wasteful, not only in its growth, but in its after preparation for market.

While cotton is in so many ways supplanting flax, in the production of fabrics formerly made of linen, it is apparent that, unless some means be devised to improve and thereby cheapen the production of flax, this branch of industry must gradually give place to its great rival.

Much has already been written by competent persons as to the best method of improving the growth of the flax plant, which is well worthy the attention of the intelligent agriculturist, I do not intend, therefore, to enter upon that subject, but would merely insist upon the absolute necessity that at present exists for turning every such improvement to account, in order that the flax crop may be made more productive, and consequently become more extended. It is plain, that flax can never be produced at what might be a minimum price, where neither capital nor skill are brought into requisition; and that such is the case generally in this country, does not admit of a doubt. This is most apparent in the steeping and other processes preparatory to bringing the article into the market. There is a loss on an average of £4 per acre in value, of seed and chaff alone, incidental to the ordinary process, adopted at present. This sacrifice is made on account of the plant at pulling time being in an unripe and undried state, the straw being then in a more favourable condition to be subjected to fermentation, and is therefore not in proper order for having the seed and

chaff removed from it. The whole plant is consequently put into the steep, where, in the process of fermentation, the seed and chaff are destroyed.

It is admitted by all, that the difficulty of conducting and controlling a process of fermentation is very great, no matter what the branch of manufacture in which it is required may be, or how favorable soever the circumstances under which it may be conducted. What, therefore, must be the loss when such a difficult and uncertain process as this, is conducted by the small Irish farmer, who has not the advantage of every-day experience to guide him, but must wait till the following season to continue the experiments or improvement of the preceding one?

Their loss on this head alone would not be overestimated if estimated at one-fifth; and yet this is exclusive of the seed and chaff, which the farmer usually sacrifices, and is therefore, entirely dependent for his chance of profit upon the fibre alone. But in the hazardous fermenting process to which he submits his flax, circumstances over which, in some measure, he may have no control, may so effect the value of this fibre, as to completely destroy, not alone all his hopes of profit, but even the chance of realizing his expenses. Again, if the crop be allowed to arrive at maturity (a course only pursued to a limited extent in this country), and the seed be saved, and the straw thereby thoroughly dried, in order to be afterwards subjected to a process of fermentation, it must be obvious to all acquainted with the subject, that the process is much more hazardous, and the results still more doubtful, as in addition to the harvesting of his crop in the dry condition, he has to contend with the difficulty of getting this dried crop to undergo a proper and effective fermentation. The substances existing in the flax plant, no doubt undergo some change during the process of drying, and hence, as a natural consequence, the fermenting process with dry straw, is found by experience to produce much less favourable results than with saw which has not been deprived of its natural sap previous to steeping.

After the steeping process has been accomplished by the grower, he has to grass and dry his flax, by its exposure to all kinds of weather, involving further risk, and demanding much time and attention. He then has to devote, not only his own time, but that of his family, and with the rudest implements he prepares his flax for market; but, in the mean time, his farm often remains undrained, his fences unrepaired, and his family untaught in those more useful and permanent employments, which, in most parts of the country, it is now in his power to do. Where the farmer gets his flax straw dressed at the mill, if we consider the time he occupies taking his crop to the mill, the uncertainty when he will have it scutched and ultimately turned out, as is generally the case, in a wasteful and not very creditable manner for market, it appears strange that the crop should have been of late years cultivated to the extent it has, and can only be accounted for by the fact, that while flax sold at a comparatively high rate, other articles of farm produce brought unremunerating prices. When the Irish farmer comes to know the proper value of his time, and has a better knowledge of his profession, he will cease to give the attention to the growth of flax which he has hitherto done, unless some measures are devised to relieve him of the risk, trouble, and expense of

this crop after it is grown. This view of the matter is confirmed by the flax operations both in England and Scotland. In either of these countries, where the farmer has received encouragement, and has a market for his flax straw, the growth of the article has increased most rapidly, in districts where it was scarcely known; whereas, where the risk, time, and expense attendant on the preparation of the crop after it had been grown, fall upon his own resources, no advance has been made in the cultivation of the crop.

With the hope of obviating these grave objections, a process patented by me about two years ago was brought before the public, and carried out extensively by the firm of John Leadbetter & Co., with whom I am connected in this matter. There are now four works in full operation, consuming the produce of 500 to 600 acres each. The main objects in view were, first, to get rid of the uncertain and objectionable mode of fermentation, then, by all the possible appliances of machinery, to arrange such a process as would, in a great measure, reduce the preparation to a thorough factory system, and thereby obtain, as far as possible, uniformity of results, without the risk of destroying the fibre. It may be here stated, that so far as this process is concerned, it has been proved that it can produce an article in every way well suited for the spinner and manufacturer, and at a lower cost per ton of fibre than has been hitherto obtained by any other patented method. What alone is wanting to insure the best possible results, is the careful attention of the farmers, not only to the growth of this crop, but the saving of the straw in a proper manner; by which, not only will the purchaser be benefitted, but he will be enabled thereby to make the crop much more remunerative to the farmer.

For a description of the process I would refer you to the following report by the Royal Flax Society of Ireland, published shortly after the process was brought before the public; merely remarking, that while the principles of the process are precisely the same as described in the specification of my patent, experience in the working out of the details has pointed out many improvements and arrangements tending to cheapen the production.

"The Marquis of DOWNSHIRE, President of the Society, read the following

"REPORT OF THE COMMITTEE APPOINTED TO INSTITUTE AN EXPERIMENTAL TRIAL ON MR. WATT'S SYSTEM OF PREPARING FLAX FIBRE FROM THE STRAW.

"Since attention was first directed to the improvement and extension of flax cultivation in Ireland, and an Association was organized at Belfast, in the year 1841, to endeavour to accomplish these ends, it has been evident that a great desideratum in the treatment of flax, in order to obtain a fibre of good and even quality, suited for manufacture, was the adoption of some plan by which uniformity could be arrived at, and the waste and loss arising from the imperfections of the system generally practised by individual growers, obviated.

"In order to attain this end, it appeared requisite that a division of labour should be carried out, that the farmer should be merely the grower of the plant, and that persons of capital, education, and scientific skill, should purchase it from him, and convert it by some effective process into marketable fibre.

"Every project having this end in view, has, consequently, met with great attention from the Royal Flax Society and the public; and a plan, embodying points of great novelty, having been lately brought forward by Mr. Watt, and put

in operation at Belfast, a meeting of those interested in the matter was held on 2nd October, at which the inventor was present, when it was arranged that a careful examination into the processes employed should be made by a Committee then appointed.

"This trial was begun on 21st October; and although all the points desirable to be ascertained have not yet been fully investigated, the Committee are in a position to report to this meeting a number of facts already ascertained, which they consider of interest and importance.

"Mr Watt's system may be briefly described as follows:—The flax straw is delivered at the works by the grower, in a dry state, with the seed on. The seed is separated by metal rollers, and afterwards cleaned by fanners. The straw is then placed in close chambers, with the exception of two doors, which serve the purpose of putting in and discharging the straw. The top, which is of cast-iron, serves the double purpose of a top and condenser. The straw is then laid on a perforated false bottom of iron, and the doors being closed, and made tight by means of screws, steam is driven in by a pipe round the chambers, and between the bottoms; and, penetrating the mass, at first removes certain volatile oils contained in the plant, and afterwards is condensed on the bottom of the iron tank, and descends as a continuous shower of condensed water, saturating the straw. This water is a decoction of extractive matter, to which attach the fibrous and more porous portions. This liquor is run off from time to time, the more concentrated portions being used for feeding. The process is shortened by using a pump, or such an arrangement as rapidly washes the mass, with the water allowed to accumulate. In about eight or twelve hours, varying with the nature of the straw, it is removed from the chambers, and having been robbed of its extractive matter, it is then passed through the rollers for the purpose of removing the epidermis, or skin of the plant, and of discharging the greater part of the water contained in the saturated straw, and, while in the wet and swollen state, splitting it up longitudinally. The straw then (being free from all products of decomposition) is easily dried, and in a few hours ready for scutching.

"In the experimental trial, personally superintended throughout all its details by the Committee, a quantity of flax straw, of ordinary quality, was taken from the bulk of the stock at the works, weighing $13\frac{3}{4}$ cwt. with the seed on. After the removal of the seed, which, on being cleaned thoroughly from the chaff, measured $3\frac{3}{4}$ imperial bush., the straw was reduced in weight to 10 cwt. 1 qr. 21 lbs. It was then placed in the vat, where it was subjected to the steaming process for about eleven hours. After steeping, wet-rolling, and drying, it weighed 7 cwt. 0 qrs. 11 lbs.; and on being scutched, the yield was 187 lbs. of flax; and of scutching tow, 12 lbs. $6\frac{1}{2}$ oz. fine, and 35 lbs. 3 oz. coarse.

"The yield of fibre in the state of good flax, was therefore at the rate of $13\frac{1}{2}$ lbs. from the cwt. of straw with seed on; 18 lbs. from the cwt. of straw without seed; $26\frac{1}{2}$ lbs. from the cwt. of steeped and dried straw.

"The time occupied in actual labour in the processes, from the seeding of the flax to the commencement of the scutching, was $13\frac{1}{4}$ hours, to which, if 11 hours be added for the time the flax was in the vat, 24 hours would be the time required up to this point. The scutching, by four stands, occupied six hours sixteen minutes. But, in this statement, the time required for drying is not included, as owing to some derangement in the apparatus, no certain estimate could be made of the actual time required in that process. It would appear, however, that about thirty-six hours would include the time necessary, in a well-organised establishment, to convert flax straw into fibre for the spinner.

"The cost of all these operations, in this experiment, leaving out the drying, for the reasons noted, appeared to be under £10 per ton of clean fibre, for labour, exclusive of general expenses.

"A portion of the fibre was sent to two spinning-mills to be hackled, and to have a value put upon it. The valuation of the samples varied from £56 to £70 per ton, according to the quality of the stricks of fibre sent, and the yield on the hackle was considered quite satisfactory.

"On the results of this experiment, which was necessarily of a limited nature, the Committee think it best to offer no general remarks. They are sufficiently

favourable to speak for themselves. It remains to be ascertained whether the qualities of flax fibre prepared by this method, are such as to suit the spinner and manufacturer. They have been informed by a spinner who has been trying some flax prepared by Mr. Watt's system, *that the yarn made from it appears equal in all respects to what is ordinarily spun from good Irish flax, of the finer sorts.* They believe that, before long, information will be given by several individuals who are about to carry out more extended trials on the spinning and manufacturing departments.

"The Committee conceive that the most prominent and novel feature of this plan consists in the substitution of maceration, or softening, for fermentation. In the steeping of flax, both by cold and hot water, the fibre is freed from the substance termed gum, by the decomposition of the latter, while in Watt's system the maceration of the stems loosens the enticle and gum, which are further separated mechanically in the crushing operation, and after the drying of the straw, readily part with the wood, under the action of the scutch-mill.

"Before concluding this statement, the Committee wish to call attention to a very curious feature in Mr. Watt's invention. The water from the vats, in place of being offensive and noxious, as is the case with ordinary steep water, contains a certain amount of nutritive matter. This arises from its being an infusion of the flax stems, in place of holding in suspension of solution the products of the decomposition of the gum and other substances contained in the stems. The inventor is now employing this water, along with the chaff of the seed-bolls, for feeding pigs. It is of much interest, therefore, to note in how far this may be found practically to answer, as between the seed, the chaff, and the water, by far the greatest portion of what the flax plant abstracts from the soil, would thus be returned in the shape of manure. However this may turn out, the avoidance of all nuisance in smell, and of the poisonous liquid which causes such damage among fish when let off into rivers, is a matter of some consequence.

"Appended to this report is a note of the time occupied in the different processes during the experiment, and of the number of persons employed in each.

"It is to be hoped that so promising a plan may, on more extended experience, be found fully to warrant the high anticipations formed from what is already known concerning it.

"(Signed on behalf of the Committee,)

"RICHARD NIVEN, *Chairman.*

"BELFAST, Nov. 3, 1852."

In the following year, at the annual meeting of the same society, detailed experiments, conducted by neutral parties, confirmatory of the previous report, were brought before the society in a communication from Messrs. John Leadbetter & Co.

They are noticed by them as follows:—

"We had also the satisfaction of procuring the results of two experiments, conducted by neutral parties, in which the same raw material was operated on (a matter of first importance when conclusions are to be established), and in which the respective merits of Watt's and other systems were tested. The first was made by Mr. Kirkwood, a gentleman sent to this country by the Canadian Government, to investigate the various processes of preparing flax. He personally superintended the preparation of the same straw under Schenck's and Watt's systems, at the respective works. That prepared by Schenck's system had the additional advantage of wet rolling, a process which was introduced by us last year. The results are contained in the following letters from Mr. Kirkwood:—

"Glasgow, June 11, 1853.

"DEAR SIR,—Agreeably to your request, I give you the result of two experiments with Canadian flax straw:

By Watt's patent—

Weight of straw before steaming	6½ lbs. 0 oz.
Weight after drying	4½ lbs. 0 oz.
Weight of scutched flax	1 lb. 3 oz.
Yield, 25 per cent.	

By Schenck's patent, with the addition of *wet rolling*—

Weight before steeping	2 lbs. 12½ oz.
Weight after drying	2 lbs. 2 oz.
Weight of scutched flax	0 lbs. 6 oz.
Yield, 17·6 per cent.	

Both samples mill scutched.

“ I am, dear Sir, your obedient servant,

(Signed)

“ A. KIRKWOOD.

“ W. WATT, Esq. Glasgow.”

“ The next letter is dated Belfast, June, 1853, and is as follows :—

“ SIR,—I took two samples of flax to the spinning-mill of Messrs. Bell and Calvert : straw nearly the same as possible. The sample prepared by Watt's process was valued, before hackling, at 12s. per stone; that prepared by Schenck's at 10s. 6d. per stone. Watt's would spin to 85's warp, Schenck's to 75's warp. The above flax was prepared under my superintendence, at works where the two systems were severally in operation.—I am, Sir, your obedient servant,

(Signed)

“ A. KIRKWOOD.

“ The next experiment was with some green straw, received from Mr. Niven, of Chrome Hill, with a request we should work it. In his report, this year, to your Society, of white-blossum flax, he gives you the following results, obtained by personal superintendence :—

By cold steeping and wet rolling—

27 lbs. green straw, equal to 8 lbs. 8 oz. win. straw.	
Steeped and dried	5 lbs. 8 oz.
Yielded	0 lbs. 12½ oz. or 14½ per cent.

By Watt's process—

38 lbs. green flax, equal to 12 lbs. 7½ oz. win. straw	
Steamed and dried	5 lbs. 4 oz.
Yielded	1 lb. 5 oz., or 25 per cent.
besides 13 oz. good seed, and 12 oz. chaff.	

“ Messrs. Hind & Son afterwards hackled these samples, and reported the following rate of yield :—

Cold steeped	57·3 lbs. per cwt.
Watt's 1st sample	59·7 lbs. „
„ 2nd do.	60·9 lbs. „

All samples would spin to the same numbers of yarn.

“ By the foregoing experiments, it will be seen that Watt's process showed the following advantages :—

Mr. Kirkwood's experiments—

45 per cent. more yield of scutched fibre; £10 per ton increased value.

In Mr. Niven's experiment—

20 per cent. more yield of scutched fibre from green straw.
 75 per cent. do. do. do. dried straw.
 5 per cent. do. in hackles, besides about £3 per acre for seed and chaff lost by Mr. Niven in steeping the flax green.”

In your Journal for February, 1854, a paper is published “ On the Patented Systems of Steeping the Flax Plant, by Mr. MacAdam, Secretary to the Royal Flax Society of Ireland,” in which he states, in reference to the

process patented by me:—"It is now pretty well ascertained that flax fibre so treated is not so well suited for spinning and manufacturing as that which has been in cold or hot water. In fact, there is every reason to believe, that the gum is but very partially got rid of by the maceration, and that fermentation is absolutely necessary in order to obtain a pure fibre." Now this statement, while it is prejudicial to the system to which it refers, is, at the same time, inconsistent with facts, and with the published reports of the Society for which he acts as secretary. From the published correspondence which Messrs. J. Leadbetter & Co. have had with the Flax Society on the subject of that paper, it will be seen, that the committee of that Society do not hold themselves responsible for the opinions of their secretary. As the above statement obtained circulation through your columns, I ask the favour of your allowing me to give the following reports, in order to show how far the above statement was inconsistent with the experience of the trade.

"Durham-street Mill,

"Belfast, 6th November, 1854.

"Messrs. J. LEADBETTER & Co.

"GENTLEMEN.—We have now finished the experiments upon the Dutch straw, prepared according to your directions, viz., 65 lbs. of flax, of the same lot of straw steeped and scutched in Holland, on the old plan, and 65 lbs. of flax, steeped and prepared according to your patented plan. The results after hackling, preparing, and spinning, were as follows:—

"The Dutch flax yielded at the rate of 64 lbs. to the cwt. of flax. The patent steeped yielded nearly 71 lbs. per cwt.; it also prepared very well, as it did not appear to lick up on the rollers quite as much as the Dutch; it also spun very well to 95's, with the water about 80°. The Dutch spun to 90's very well, with the water at about 130°, but we found on weighing the yarns of both, after spinning, that the loss from the state of line to the state of yarn, was nearly the same in both cases, and we think considerably more than could have appeared had we had a larger sample to experiment upon; part of each lot was spun down about fifteen numbers to make warp, to use up the weft when carrying the experiment into the state of cloth. We offer no opinion upon the yarns produced from these experiments, as we presume the party who manufactures into cloth will be better able to judge of their relative qualities, when it is seen how they work, than we are.

"We remain, Gentlemen, yours respectfully,

(Signed)

"JOHN HIND & SONS."

The above experiments were made on flax produced from the same unsteeped straw, one part having been put through the Dutch process in Holland, the other portion having been sent here as straw; the fibre was produced at one of our works. The experiment was gone into at the request of parties interested in the trade in Holland.

"Killyleagh, 16th January, 1855.

"Messrs. J. LEADBETTER & Co., Belfast.

"GENTLEMEN.—From the experience I have had in hackling and spinning flax prepared by Watt's process, I am satisfied it is well suited to the general wants of the trade in the North of Ireland.

"Having wove the yarns spun from the flax, I have found that it resists the action of the loom even better than ordinary yarns, and it makes an excellent cloth, without the usual process of boiling.

"Yours sincerely,

(Signed)

"JOHN CARR."

"Springfield Bleach Works,

"19th January, 1855.

"DEAR SIRs.—Having bleached and finished a parcel of linens for you, a portion of which were represented to us as being manufactured from flax prepared by Watt's patent, and the remainder prepared in the ordinary way, we beg to say that we found the former to bleach fully as readily as the latter. We may also add, that if we had the option of bleaching the two descriptions, we would, most decidedly, prefer the former, as we consider the fabric will better stand the operation of bleaching, and will consequently be stronger when finished.

(Signed)

"A. HODGKINSON & Co.

"Messrs. J. LEADBETTER & Co."

"Belfast, 19th January, 1855.

"Messrs. J. LEADBETTER & Co., Belfast.

"DEAR SIRs.—In reply to your inquiry, we have much pleasure in stating that we have used several parcels of the flax we bought from you, which had been prepared by Watt's process, and have found it more carefully selected and better handled than any Irish flax we have used; it is also quite as easily heckled and spun as any other flax we are in the habit of using. It is rather our advantage that it is easily spun in cold water.

"It appears to us that the process is safe for producing either warp or weft flax, and does not alter, in this respect, the original character of the fibre upon which it is brought to bear.

"Having visited the works at Newtownards, the writer is of opinion that by this process a much larger amount of fibre, seed, and refuse, is economized, than by the ordinary method of retting.

"We have no doubt that yarn spun from Watt's flax will be quite as easily woven as any other linen yarn, but have not such experience of this as will enable us to speak with certainty, nor can we make any statement regarding its bleaching quality.

"We are, dear Sirs, yours respectfully,

(Signed)

"A. W. CRAIG & Co."

"Ligoniel, 19th January, 1855.

"Messrs. J. LEADBETTER & Co.

"DEAR SIRs.—We beg leave, at the request of your foreman, Mr. Whyte, to give you our experience of your patent steeped flax, as we have worked several lots of it. We do not find any difference in the spinning quality in comparison to appearance with other flaxes steeped in the usual way; the only thing we have to say is, that we have had some complaints from manufacturers that it did not boil a good colour.

(Signed)

"We are, yours truly,

"STEWART & McCLELLAND."

"Rockrilla Weaving Factory,

"Glasgow, 13th January, 1855.

"Messrs. JOHN LEADBETTER & Co.

"GENTLEMEN.—We beg to inform you that the linen warp you last sent us wove with facility in the ordinary cotton looms, and at the usual speed.

"The above warp, you stated, was spun from flax prepared on Watt's patent principle, and was dressed according to your instructions.

"We remain, Gentlemen, your most obedient servants,

(Signed)

"MITCHELL & WHYTLOW."

"Lisburn, 2nd February, 1853.

"DEAR SIRs.—We have the pleasure to return the piece of linen made from flax prepared by Watt's patent process, which you sent us to bleach, and notwithstanding its sputty dark appearance, it was brought to its present state of whiteness with less difficulty than the average of grey cloth we meet with; and we are of opinion that practical experience is wanting to render Watt's process a valuable acquisition to the linen trade.

"Yours very truly,

(Signed)

"RICHARDSON & Co.

"Messrs. J. LEADBETTER & Co., Belfast."

I may add that experience of the weaving properties of yarn spun from flax, prepared by my process, have been very satisfactory, and in general the yarns are used as they come from the spinner, without the trouble and expense of the boiling process; they are in daily use in the manufacture of most of the fabrics commonly made in this neighbourhood. It would therefore appear from the above reports, that flax can be produced of a character suited to the wants of the trade, in a way not involving the risks and disadvantages previously enumerated.

By the extension of this or similar systems, the agriculturist would only incur the legitimate risks of his trade, and would obtain ready sale for his produce, as soon as it was ready for being removed from his farm. A great impulse would thus be given to the extension of the growth of flax. The flax preparer would then have his whole time devoted to the preparation of the fibre, and from daily experience obtain results which the mere yearly experimenter, as the farmer might be called, could not obtain. The seed and chaff would thus be saved, which are most valuable to the farmers for feeding purposes, and instead of the noxious steep-water, a nutritious liquid is obtained, which is in daily use as part of the food of cattle. There is besides, in this method of preparation, no risk with any ordinary care of destroying the fibre, and the results are therefore much more uniform. It is to the extension of such or similar works that we must look for the legitimate extension of the growth of flax in these countries. From the causes already stated, and from the present high price of cereal crops, I fear the farmer who has the knowledge of flax steeping, &c., will gradually avoid the labour and risk attending on his flax crop; and we cannot, under the present system, look for any advance being made amongst that portion of our farmers who have yet to learn the art of producing the fibre for market.

It therefore behoves all connected with the linen trade to watch these changes so prejudicial to their interests, to examine into the causes, and if possible to apply the necessary correctives.

I have the honor to be, yours sincerely,

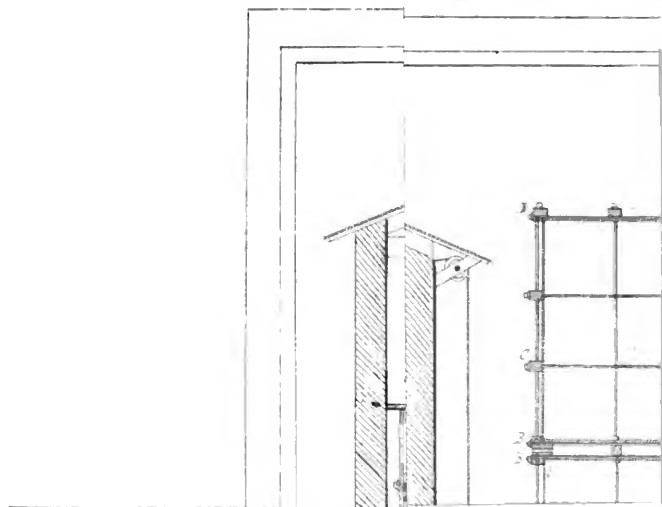
W. WATT.

ART. II.—*On the Preservation and Storage of Corn, by the method of*
M. HENRI HUART, of Cambrai. Second Article.

(From the *Publication Industrielle* of Armengaud, Part II., Vol. IX.)

AFTER what has been previously said, we are enabled to estimate the great importance of the question of providing permanent magazines of supply, and of the improvement of corn; a question which becomes of graver and more general interest in times of dearth.

It will, however, be more clearly comprehended, now that this complex problem has been solved by the machine, which we are about to describe:



Description of M. Huart's Machine, as represented on Plate I.

The first figure represents a vertical transverse section of a reserve store, which we will suppose to be from 30 to 33 feet in width.

The second figure is a longitudinal section of the same, exhibiting two rows of reservoirs, one of which is supposed to be viewed from the exterior, and the other sectionally. It will be seen that it could contain a greater or less number of them, according to the amount of disposable space, and that it is divided towards the centre by an open space, from 15 to 30 feet, for the admission and passage of corn.

The third figure is a horizontal section of that portion of the machine corresponding in height to the line 1—2.

These figures are designed on a scale of $\frac{1}{80}$.

The fourth fig. exhibits, on a larger scale, a vertical section of the lower part of one of the hoppers, in order to give a clear idea of the arrangement of the divisions, or oblique partitions, which are there used for the purpose of giving an equable movement to running corn throughout the whole horizontal section, corresponding to the length of the aperture at its base.

Fig. 5 is a plane which corresponds to fig. 4.

We must first observe, that the whole apparatus consists of the following principal parts:—

1. A series of reservoirs capable of containing quantities of corn varying from 100 to 1000 hectolitres (34.39 to 343.90 quarters).
2. An endless screw, provided with flappers, and elevators which direct and raise the corn.
3. Sieves and ventilators to separate weevils, worms, moths, dust, chaff, and rotten grains from corn, before it is let fall into the hoppers.
4. A sack-lift to supply the machine.
5. A small steam engine to set the whole in motion.

We will now describe each of these arrangements separately.

Hoppers or Corn Reservoirs

As will be seen by the plate, the store or granary of reserve, is composed of a series of vertical spaces or reservoirs A, which may be considered as independent of each other, each being filled and emptied separately. Their main height is little more than 30 feet, and their horizontal section is a rectangle of 12 feet in breadth, by variable lengths of from 9 to 30 feet. Each reservoir is formed, at the angles, of four vertical oaken posts BB, (plan fig. 3,) and at the sides, of parallel and more slender posts CC. The latter are connected together by iron rods α , which strictly preserve the distance between the sides throughout the whole apparatus. For that purpose they are placed closer in the lower part than in the upper, where the weight is less.

The whole rests upon a horizontal timber platform A, which is firmly based on solid blocks of masonry D, capable of supporting the whole weight of the machine, whatever be its height; this masonry is so constructed as to separate completely the reservoirs from the external walls, which, however, are not always necessary, and may be dispensed with.

The posts BB of the angles are grooved, in order to receive the boards *b*, that form the sides of each of the reservoirs, which, though independent, are yet connected together (as shown in plan by fig. 3) by the same separating rods, in order to present a complete and solid whole. The lower part or base of each reservoir is terminated by four planes, inclined at an angle of 45° , so as to form inverted prisms, which, in fact, may be considered as their hoppers.

Each of these is composed of timber planks *b*, sustained by the beams *a*, which rest on the one hand, upon the platform A, and on the other, upon a second analogous, but smaller platform A², based in like manner on the projecting part of the masonry.

The internal construction of these hoppers or bases of the reservoirs is quite peculiar, and constitutes of itself, we do not hesitate to say, a true invention, to which we ought the more especially to direct the attention of our readers, as it solves a very difficult problem, which had not been until then sufficiently studied.

It is well known, that when a closed aperture at the base of any receptacle whatever, filled with corn, is opened, the grain runs in a very irregular manner; thus the rapidity is much more considerable in the vertical line corresponding to the centre of the opening, and visibly decreases more and more towards the lateral sides to such a degree, that the movement is scarcely perceptible near the vertical sides of the reservoir, while the central part descends with extreme swiftness.

It is not thus with M. Huart's arrangement. It consists in separating the hoppers by a series of parallel divisions *c* (fig. 4 and fig. 5 in plan, at the line *b b* of fig. 4), which, like the two external, *o n* and *m o*, are inclined at an angle of 45° , in order to make the surface of the line *a b*, correspond to that of the orifice *o*.

The inventor has determined the positions of these various partitions in the following manner:—

The horizontal line *m n* having been divided into a certain number of equal parts (into 7, for instance), from the centre of this line the perpendiculars *R q* and *R r* are let fall on the sides *m o* and *o n*, and from the points 1, 2, 3, &c., parallels are drawn to the sides *m n* and *o n* until they meet the perpendiculars *R q* and *R r*.

The planks *c* in this place, indicate the first series of partitions for separating the descending masses of corn. From the points of contact, with the perpendiculars *R q* and *R r*, 1, 2, 3, &c., perpendiculars are then let fall in like manner on the horizontal line *q r*, whose length is equal to half that of the line *m n*. From the centre *s* of the line *q r*, the perpendiculars *s t* and *s u* are drawn to the sides *m o* and *o n*.

From the points 1², 2², 3², &c., parallels are again drawn to the sides *m o* and *o n*, until they touch the lines *s t* and *s u*.

The planks placed there represent the second series of divisions for separating the descending corn.

The line drawn through the points *t u* is equal to the fourth part of *m n*.

We may observe that the passages left between the parallels of the second series of oblique partitions, are one-half less than those of the first series.

"This arrangement could be continued indefinitely," says M. Huart, "if experience had not shown that we ought to preserve certain proportions in the spaces reserved for the passage of corn."

"We have then divided the line *t u* into four equal parts."

At the three points *x*, squares have been made, whose sides form four equal passages *z*, which unite in the two passages *y*, formed by the lower sides of the large square which supplies the final passage *o*.

By means of these various combinations, the aperture *o* is placed in proportional and successive relation to the different surfaces *t u*, *q r*, *m n*, so that the seven intervals of the line *m n*, equally assist in the passage of the corn. In this manner the corn contained in the reservoirs descends horizontally throughout the whole surface of the apparatus.

We have been enabled to confirm this fact ourselves, by visiting M. Huart's stores. M. Huart having conceived the happy idea of placing glass instead of planks over the line *m n*, about 25 centimetres ($9\frac{3}{4}$ inches) in height, and extending over the entire width of the hopper, the manner in which the operation took place was easily seen when the lower aperture *o* was open. Each layer of corn, in the whole horizontal section, descended as regularly as if it had run through an opening as large as the section of the reservoir. The passage *o* formed between the beams *a* terminates in traps or wooden registers *d* (fig. 1), in order to stop at will the passage of corn. As soon as a register is open, the corn runs on the moveable conductor *E* (figs. 1 and 2), which can be easily shifted before each space, to supply the endless screw.

From this it follows that the corn runs through vertical divisions, the thickness of which is comprised between the two beams *a a*, and at the same time by horizontal layers, equal in width to the corresponding surface of a division throughout the whole breadth of the reservoir.

It will be seen by the plate (fig. 1) that this arrangement applies to half of a reservoir.

The corn runs through the spaces left by the squares on these conductors, and falls into the semicircular iron cylinders *F* (seen in cross section in fig. 1), the length of each of which is equal to that of the reservoirs (fig. 2), and which are connected by their extremities to wooden frames *G*, so placed as to support the elevators, of which we will now speak.

Endless Screws and Elevators.

Each cylinder encloses an endless screw *H*, which is intended to bring corn from one end to the other, by constantly agitating it, so as to pour it into the box *I* of the corresponding elevator. These screws are formed of round blocks of wood, on iron pivots, surrounded with an iron or tin spiral from 18 to 20 centimetres (about $7\frac{3}{4}$ inches) wide.

In order to force the corn, while advancing, to rise above the axis, M. Huart has added small thin flappers *g*, at the summit or exterior of the spiral. These flappers, taking at each revolution a certain quantity of corn, agitate it and recast it into the cylinder, so that it is constantly shaken in its passage to the elevator.

By this arrangement, as simple as it is ingenious, corn is freed from any dust it may contain, at the same time that it is deprived of a portion of its moisture. It thus advantageously supersedes the ordinary method of shovelling.

As the space on each side of the screws, between the blocks of masonry which support the reservoirs (a space which is necessary besides, in order to allow of the passage of workmen), forms, with the spaces I, also left between the reservoirs, a kind of ventilators, the currents of air drive out all dust and moisture. The heavier particles which fall to the bottom, are easily removed by the man charged with the management of the machine, especially with changing the position of the moveable conductors E, whenever it is deemed advisable to do so. If necessary, this operation could be effected mechanically by means of catches and spring-work, moved by the same motive power as that by which the machine is worked.

From fig. 2 it will be seen that the same screw, and consequently, the same elevator, can serve for all the divisions of each side, which are, as we have said before, opened successively and at certain intervals. We may assume that if a mechanism were used to change the position of the moveable conductors, it could be so arranged as to cause the alternate opening or closing of the registers or traps. The elevators or endless chains T, ascend above the upper flooring of the machine, and pass at the exterior of the reservoirs, through the narrow space between them. There is nothing particular in their construction; they are formed of an endless leather or gutta percha strap, running on two parallel pulleys, and covered with strips of wood or iron.

Sieves and Ventilators.

These endless chains thus lift the corn which has been brought to them by the endless screw to the top of the inclined sieves or winnowers K, which are composed of sheet iron, with holes so close as not to admit good corn, but yet sufficiently large to allow weevils and bad corn of smaller size to pass through them and fall into a kind of wooden box L (fig. 1), whence they are taken when it is full.

The corn spreads over the whole length of the sieve, and runs on the inclined planes *h* (fig. 1), by which, if necessary, it can be brought back to the same reservoirs, in order to subject it to the same process again, as long as it remains in the store. In this passage all the corn is exposed to the action of a current of air, introduced by a ventilator M, which is placed at the opposite end, and which, taking the air from without, forces it into the lower horizontal conductor *j*, through which it acts on the end of the oblique passage *k*, formed by the inclined planes.

The working of the sieve can be regulated with great accuracy by changing its inclination. For this purpose it is connected at the top by pivots to the wooden or iron frame N, which supports the apparatus, while the lower extremity rests on two pegs, which are placed in either of the holes *i*, pierced in the side of the box, which closes the oblique passage *k*.

Sack-lifts.

In order to supply the granary, a sack-lifter is usually placed, as in mills, on the upper platform; it serves either to raise the sacks of corn from without (S, fig. 1), intended to be stored, and worked by the machine, or, on the contrary, to discharge all corn destined for grinding, after it has remained sufficiently long in the reservoirs.

Communication between the interior and exterior of the store is effected by ropes and pulleys, while trap-doors are placed in the interior which admit the passage of the sacks.

The Motive Power and General Movement.

M. Huart uses in his store at Cambrai, which is some distance from his mill, a small steam engine of about two-horse power, to set the sack-stretchers, elevators, endless screws, and the ventilators of the winnowers in motion. The engine is horizontal, supported on two wooden blocks, and its motion is at the rate of from 100 to 120 revolutions per minute. The boiler is placed on a furnace apart, outside the store, in order to prevent the danger of fire.

A pulley fixed to a revolving axle communicates its motion either to an intermediate axle, sufficiently long to command the various apparatus, or directly to the axle of the sack-lifts; and from this, other pulleys are connected also by leather straps with those placed on the summit of the elevators, which naturally draw the endless screws into their rotation, or the axis of the ventilator of each winnower.

The diameters of these various pulleys are so combined as to give to each apparatus the requisite quickness of rotation. These details, however, are so simple and ordinary, as to render it unnecessary for us to dwell on them, and every one will easily comprehend them. We shall merely observe, that when the stores are next to mills, or to any reservoir whatever using a motive power, it is useless to apply a special motive power, by taking from this power a part necessary for setting the apparatus in motion.

Mode of Supplying M. Huart's Granaries.

From the preceding description, the method by which such granaries are supplied and worked, will be easily understood.

The cars laden with corn, on arriving at the foot of the store, are unloaded by means of sack-lifters. For that purpose a man is placed on the platform at the top, to unfasten the sacks, and another carries them on wheelbarrows to the interior, while the carman below attaches the sacks in succession to the cord by which they are raised. This proceeding, which takes place only when new corn is brought to the store, or when the old is carried off, is precisely the same as that ordinarily in use both in mills and corn stores.

The two men employed in unloading cars and supplying the store, also suffice for the working of the various apparatus connected with it. Thus, one of them usually remains in the lower part, to open or close the hoppers,

to change, as we have described, the place of the moveable conductors, to remove dust and dirt, and finally, to see that the endless screws and elevators work efficiently. He can also supply the boiler, when a special steam engine is employed. It will be seen, that as the reservoirs do not operate together, but alternately, this man has fully sufficient time to perform his duties with all desirable regularity, even though the reservoirs were numerous and contained a large quantity of corn.

The second man remains at the top of the store to superintend the motive power, the winnowers and their ventilators, to stop or set in motion the several elevators, to remove the weevils, chaff, and earthly particles that are separated from the corn in the winnowing. He is not overtaken in this occupation, as it occurs only at greater or less intervals.

It can then be said that the working of the machine is extremely simple and easy, that it is effected with the utmost punctuality, and that corn, whatever be its quality and quantity, comes out of these granaries, after having been operated on, considerably improved. If moist, it becomes perfectly dry; if full of dust and weevils, it is thoroughly cleansed from both. It becomes so improved as to be quite fit for grinding.

Two men suffice for the superintendence of 10,000 hect. or 3,439 quarters.

Advantages of M. Huart's System over other methods.

The problem of the preservation and improvement of corn being completely solved by M. Huart's granaries, we shall now examine whether they are really practical to commerce in general, whether their cost would be too high, and lastly, whether private speculators and the state could safely engage in forming reserves on such a system.

We must first observe that—as will be seen from the plate and the description—the construction of the reservoirs is extremely simple and economic; the various apparatus, as the screw, the elevators, the winnowers, &c., which are now made everywhere, are equally simple in their construction. M. Huart, who has formed an exact estimate of all expenses for stores of different sizes, asserts that they could be easily established at the rate of from 4 to 5 francs per hectolitre, of a size suited to most localities, or 9s. 4½d. to 11s. 8¾d. per quarter; and 6 francs at most for towns in which wood and labour are dearer, or 14s. 1d. per quarter.

Thus a Huart granary, capable of holding 10,000 hectolitres (3,439 quarters) of corn, would amount only to 40,000 francs (£1,600), or at most to 50,000 francs (£2,000).

If we compare those figures with the cost of the various methods which have been heretofore proposed, we will immediately perceive the advantage of M. Huart's in this respect.

According to the papers which we have consulted on this subject, we find that the two corn pits constructed at the Hospital of St. Louis, in 1819, and capable of containing 260 hectolitres (89·4 quarters), cost 4,712 francs (£188 9s. 8d.)

We should remark, however, that their construction was very economic, and that they would not in all probability be suited to operate on a large scale.

We have seen that M. Vallery's moveable granaries, capable of holding 1,000 hectolitres (343·9 quarters), cost 6,000 francs (£240), or 6 fr. 60 c. per hectolitre; and that we should estimate granaries of smaller size, at from 7 fr. to 7 fr. 50 c. per hectolitre.

The store on the *Quai de Billy*, constructed by the military engineers for the retention of provisions in Paris, and which are built with great solidity, have risen to a price considerably higher, if we calculate it only by their capacity for holding corn.

These stores are five storeys high, with six platforms, whose entire superficies is 7,861·6 square metres; deducting 949·87 square metres for the stairs, hoppers, sack-lifters, and other empty parts, there remains 6,911·73 square metres of surface to receive corn.* The ground floor, which has a surface of 1,390·99 square metres, is more especially intended to receive corn in bags; they are placed one upon the other, as far as eight deep, and they may sometimes remain thus three or four months, according to their nature and quality. Corn lies in masses on the floors of the other storeys in regular layers of from 65 to 70 centimetres in height.

Those charged with the distribution of this corn, endeavour as much as possible not to exceed this height, in order to prevent it from heating, and to facilitate its management, ventilation, &c.

In short, according to the careful abstract with which we have been furnished, the building has cost the state 568,451 fr. 83 c., including an expenditure of 12,000 fr. for a bridge connecting the stores with the mills, built on one side, and the pavements and approaches to them.

As their greatest external dimensions are 44·56 metres in length, by 33·28 metres in width, thus giving a horizontal section of 1482·96 square metres, we find the price amounts to 383 fr. 35 c. the square metre.

The quantity of corn capable of being stored in these magazines being from 38,000 to 40,000 hectolitres (from 13,068 to 13,756 quarters), the average cost amounts to 14 fr. 20 c. per hectolitre, or £1 13s. 4d. per quarter.

Without requiring any additional support for the beams or walls, M. Huart could make such a building hold from 140,000 to 160,000 hectolitres (from about 48,000 to 55,000 quarters), that is to say, three to four times the quantity which can be actually stored in it at present.

The minimum cost of an ordinary store, built at less expense than that of the *Quai de Billy*, is 8 fr. 30 c. per hectolitre, allowing the requisite space for shovelling, winnowing, and all the internal work, or 19s. 5½d. per quarter.

We see then, that of all the various methods in use for storing corn, M. Huart's is the least expensive, and most easily established.

Expense of Maintenance, Storage, &c.

M. Huart proposes the establishment of granaries of reserve in various parts of France, which would admit of considerable economy in the rent and working, as compared with the actual expenses of the stores generally used.

* An error occurs here in the original, which makes the available space 7,766·074, instead of 6,911·73. It is impossible to know which of the data is erroneous.

We will suppose, for instance, a store capable of holding 100,000 hectolitres of corn, with an average of transactions upon 75,000 hectolitres, we would have the following result, assuming for base of our calculation the usual prices of different seaports and other commercial places.

Capacity, 100,000 hect., at 5 fr. per hect. 50,000 fr.

Expenditure.

500,000 fr. at 4 per cent. interest	...	...	...	...	20,000
Two men for every 10,000 hect., at 2 fr. <i>per diem</i> , for 300 days,					12,000
Steam engine of 2-horse power, per 10,000 hect. (20-horse power), and 4 kilogrammes of coal per horse power, per hour (80 kilog.) for 10 hours' work (800 kilog.), at 3 fr. per 100 kilog.=24 fr., say for 300 days,	...	...	...	...	7,200
Assurance,	...	..	...	...	1,000
Taxes and Rent,	..	...	...	..	1,000
A Superintendent,	...	...	...	...	3,000
An Under-Superintendent	...	...	...	...	2,000
Other Expenses	...	..	...	...	3,800

50,000 francs.

Receipts.

We may allow that of every 100,000 hectolitres, 75,000 will be always utilisé, and that commercial transactions will yield the following results:—

4 cutries, at 5 c., or 20 c. \times 75,000,	...	...	...	...	15,000 francs
4 salties, at 5 c., or 20 c. \times 7,000 as before	...	...	...	..	15,000
Winnowings and ventilations at 5 c.	...	...	...	...	3,000
12 months' rent, at 5 c. per month = 60 c.	...	...	...	...	45,000

78,000 francs.

According to this estimate it will be seen that a fair profit may be reckoned on.

We will also estimate to the cost of a private establishment, taking as base a capacity of 10,000 hect., and we find according to M. Huart:—

Capital requisite to establish a store for holding 10,000 hect.,
at 5 fr., 50,000 francs.

Expenditure.

50,000 francs at 4 per cent. interest	...	...	...	...	2,000 francs.
Two men at 2 fr. per day, for 300 days	...	...	...	...	1,200
Fuel*	...	...	...	...	432
Miscellaneous expenses	...	...	...	...	368

Annual expenses for 10,000 hectolitres, or 3,439 quarters of corn, would be } 4,000 francs.
Or 40 centimes per hectolitre, or only 3·3 centimes per month.
Or a very small fraction over 11d. per quarter per annum,
or less than 1d. per month.†

* An error appears in the calculations upon this item in the original. which we are not in a position to correct. It does not, however, appear to be one which would affect the final result.

† In order to enable any of our readers who may wish to examine in detail

The Minister of War, after having had M. Huart's system carefully examined by the *Commission Supérieure des Subsistances*, composed of the most intelligent engineering officers, has just ordered him to apply it on a large scale to the stores of the *Quai de Billy*.*

We would willingly notice here the learned and able report on this subject, which has been drawn up by one of these officers, M. Dantrelaine, had not the many details into which we have already entered, rendered this article very long. We cannot resist, however, quoting a short extract from it, in order to show that the Commission, like ourselves, appreciate the services which may be expected from this method of preserving and storing corn.

"The ventilation," says M. Dantrelaine, "is constant; the corn flowing through the lower aperture in little sheets into the lower bucket, made to revolve by the screw, received by the elevator, transported by the endless chains to the top of the granary, and cast by them on the sieve, where it is cleansed and ventilated, and falling again in showers upon the heap of corn in the store, is thoroughly shaken and separated, so that all the grains without exception are several times subjected to the beneficial effects of currents of air.

"These several operations free corn so completely from impurities of all kinds, that on leaving the granary, it leaves after the ordinary cleansing for the mill, only a waste of one-half per cent.; and not a trace of weevils is found.

Corn is dried in the Huart granary by the operation of the machine itself. Corn stored there in a moist state, soon acquires a degree of toughness and flexibility, becomes polished, runs on the hand, and becomes so dry, that M. Huart, who is also a miller, is obliged, in order to give it the requisite degree of humidity for grinding, to subject it to a jet of steam some hours before sending it to the mill.

"The Huart granary," adds the reporter, "is like an open vat when the machine is at rest. It is unquestionable that the temperature of the internal spaces cannot rise to the same height as at the exterior. Finally, considered simply as a means of storage, its superiority over ordinary granaries is manifest as much from its larger capacity as from its greater economy." This we have shown above.

As regards the expense of maintenance, the advantage of the Huart granary is still more remarkable.

Thus M. Dantrelaine calculates that by this method the cost of

the preceding estimates, we shall give the following comparisons of French and English weights and measures:

1 kilogramme = 2.2048571 pounds avoirdupois.

1 hectolitre = 2.7512109 bushels, of which 8 make 1 quarter.

1 franc = 100 centimes = 9.69d.

10 centimes are therefore less than 1d. (0.969), and 1 centime less than the tenth of a penny.

* The perfect success of Huart's granaries has been now so well established, that the French Minister of War is about to have the *whole* of this vast establishment converted into a Huart granary.—ED.

preserving a hectolitre of corn would not exceed 30 centimes per annum, including accidental expenses, while it would amount to 2 fr. 25 c. in military stores, by employing labourers, paid at the rate of 45 sous (1s. 10d.) per diem of 10 hours; besides which the labour of these workmen would not, with the closest superintendence, by any means produce the advantages given by the simple and regular operation of M. Huart's mechanism.

Finally, M. Dautrelaine thus sums up the advantages of this method:—

“Moderate in its first cost and in the expense of maintenance, affording ample space, periodic or continued motion of the whole mass of corn, ventilation, winnowing, preservation of a low temperature, progressive dessication, and safety from the attacks of insects and vermin.”

ART. III.—*Observations on the Cost of Cutting Turf in Ireland.*

IN No. 9, Vol. I. of this Journal, we gave a number of very important data relative to the cost of preparing turf in France, in the hope of eliciting some analogous information relative to our bogs. Any one who considers what a large share the possession of fuel has in the development of manufactures, will be able to appreciate what a great source of wealth we possess in our peat bogs, if properly worked. This must be our excuse for so constantly bringing the subject of the uses of peat before our readers, for it really is our greatest undeveloped resource.

Although so sanguine of the benefits which the country might derive from a proper working of our bogs upon a large scale, we are not unmindful of the very great difficulties which beset the problem—difficulties which seem to increase in proportion to the magnitude of the operations; offering in this a contrast to almost every other manufacture. Turf, as cut in the proper season, on a small scale, by a farmer for his own use, is undoubtedly a cheap fuel; but when some thousands of tons of it are required to be cut from a limited area, it becomes expensive, owing to the necessity which will then exist of cutting canals for draining the bog, and facilitating the transport of so bulky an article.

That the preparation of peat in larger quantities than is required for domestic purposes, by the persons in the vicinity of bogs, must be attended with considerable difficulty, is shown by the fact, that manufacturers, such as distillers in Galway and Limerick, although admirably situated with regard to supplies of turf, import coal, which generally costs them £1 per ton, and often much more. Allowing that one ton of coal is equivalent in heating power to three tons of turf, this fact proves either that turf costs 6s. 8d. per ton, or that the supply could not be depended upon.

There are a few manufacturers, however, favorably situated, who manage to command a supply of turf, and who find great economy in its use. In one instance at least, a large distiller who employs no other fuel, considers

that his turf is equivalent to coal at 8s. per ton, a price at which it can scarcely be had now in the coal districts of England itself.

Several causes contribute to the backward condition of the exploitation of our bogs, the chief being, of course, that which impedes our progress in almost everything else, the present land system, which prevents the peasants from creating an industry with turf, while the present proprietors of the bog are equally deprived of benefit from their possession. Another cause is their immense extent, which renders large drainage works necessary, as we have already observed. Perhaps another cause why turf has made but little way as a fuel for manufacturing purposes, is the difficulty of determining its exact value as such.

Any person who seeks for information with respect to the cost of turf in Ireland, will meet with the strangest discordance in the estimates which he receives. This arises from the fact, that turf is purchased by bulk and not by weight, and by the great diversity of quality which the turf, prepared even from the same bog, presents. We have received two statements from the same locality; according to one, a ton of turf could be stacked on the bog for 2s.; according to the other, it would cost 6s. That is to say, if a person about to set up a factory, had applied to the first person, he would have told him that an equivalent of one ton of coal would only cost 6s., whilst the other would have told him that it would cost 18s., a most important difference truly!

As we have recently had an opportunity of examining the relation between the bulk and weight of turf upon a large scale, we shall give a few data which may be useful to those interested in the employment of peat fuel, or the cutting of turf on a large scale for any other purpose. They will at least serve to correct such wild estimates as the foregoing.

It is well known that in the great bogs which occupy the plains, such as the bogs classed under the name of Bog of Allen, the peat presents considerable and well marked differences, as we proceed from the surface downwards. That forming the surface layers consists almost wholly of the remains of moss or some other plants, but little altered in structure, and exceedingly spongy. When cut and dried it produces a light yellowish turf which burns readily and leaves little ashes, but is of little value as a fuel. Below this comes a peat composed of a greater variety of vegetables, but whose structure is more or less altered, and which yields a brownish turf, having but little ash when burned, and much denser and heavier than the former, and constituting a very good fuel. Below this, and resting usually on beds of marl, comes a still denser peat, in which the vegetable structure has been almost obliterated, and which yields a dark brown or black turf, giving much more ashes than the last mentioned. This turf, when not mixed with the subjacent clay, forms an excellent fuel for steam boilers.

In some small bogs only black peat is found, and in most mountain bogs it is the same. The proportions in which the three kinds exist in the larger bogs is very variable, the spongy peat being often 7 and 8 feet in the centre of great bogs, and only a couple of feet towards its edges.

In judging of the cost of turf, it is of the greatest importance that its

character be first determined, for in purchasing it by measure, we may have the price per ton of the upper spongy turf as much as three times that of the underlying black turf. In giving the following data we shall keep this distinction in view. No black turf, properly speaking, was weighed; but we may consider the dense brown variety where it passes into the black, as a good example of the average quality of the best fuel in a deep bog.

The bog from which the turf weighed in the following instances was obtained, is one of the great central bogs, and contains about 5,000 acres, and is in some places 40 feet deep, the average depth being fully 25 feet. The standard measure of the locality is the kish of 24 feet.

Upper light Moss Turf.

Number of kishes weighed,	...	...	...	...	840
Maximum weight of any kish,	...	...	...	2 cwt. 1 qr. 12 lbs.	
Minimum weight of any kish,	...	...	...	1 " 1 " 5½ "	
Average weight per kish of the entire quantity,	...	1	"	3 " 11 "	
Number of kishes to one ton of turf,	...	...	...	10·8	
Number of cubic feet of stacked turf to one ton,	...	...	...	259·2	

A second quantity of the same kind of turf, consisting of an entire clamp, weighing 12 tons, 0 cwt. 1 qr. 10 lbs., gave the following data:—

Total number of kishes,	...	...	...	126½ = 3030 cubic feet.
Average weight of a kish,	...	...	...	1 cwt. 3 qr. 17 lbs.
Number of kishes to one ton,	...	...	...	10·5
Number of cubic feet of stacked turf to 1 ton	...	...	...	252

Average good Brown Turf.

This turf represented the kind which could be obtained in greatest abundance, and might almost be considered as the average of the whole bog, and consequently of most of the large central bogs.

Number of kishes weighed	...	...	...	...	2,651
Maximum weight of any kish,	...	...	...	3 cwt. 0 qr. 20 lbs.	
Minimum weight of any kish,	...	...	...	2 " 1 " 18 "	
Average weight per kish of the entire quantity,	...	2	"	3 " 0 "	
Number of kishes to one ton of turf	...	...	...	7·27	
Number of cubic feet of stacked turf to one ton	...	...	...	174·48	

Dense Brown Turf.

This kind of turf is obtained from the peat found at considerable depths in the bog, and is perhaps the best for fuel which can be obtained from the deep bogs on the plains, but would perhaps be inferior to the average mountain turfs.

Number of kishes weighed	...	...	...	...	1,695
Maximum weight of any kish,	...	...	...	4 cwt. 3 qr. 8 lbs.	
Minimum weight of any kish,	...	...	...	3 " 0 " 22 "	
Average weight per kish of the entire quantity,	...	3	"	2 " 17 "	
Number of kishes to one ton of turf	...	...	...	5·47	
Number of cubic feet of stacked turf to one ton	...	...	...	131·28	

The whole of this turf contained perhaps on an average 30 per cent. of water; that is the condition in which turf is usually stacked before winter.

As a good deal of valuable information upon this subject must be in the possession of many of the readers of this Journal, which, if brought together and published, would undoubtedly tend to the use of turf as a fuel for

manufacturing purposes in many districts where highpriced coal is now employed, or where the price of fuel would impede the establishment of factories, we subjoin a number of queries, to which we solicit answers from different parts of the country. Should we receive a number of such answers, we shall lay an epitome of them before our readers. Each statement might be conveniently made in the following form:—

NAME OF BOG.	COUNTY.	BARONY.	PARISH.
<ol style="list-style-type: none"> 1. Average depth. 2. Extent in acres, (stating whether Irish, Statute, or Cunningham.) 3. Weight of one cubic foot of flow or surface peat, as cut from the bog. 4. Dimensions of one cubic foot of flow peat after it has been sufficiently air-dried to be fit for fuel. 5. Weight when so dried. 6. Weight of one cubic foot of good average brown peat in the same state. 7. Dimensions of one cubic foot of average brown peat after it has been sufficiently air-dried to be fit for fuel. 8. Weight when so air-dried. 9. Weight of one cubic foot of good black peat in the same state. 10. Dimensions of one cubic foot of good black peat when sufficiently air-dried to be fit for fuel. 11. Weight when so dried. 12. Number of hours required by a man to cut 100 cubic yards of bog stuff. 13. Cost in labour for cutting 100 cubic yards of bog stuff. 14. Cost for wheeling. 15. Cost for footing or drying. 16. Cost for clamping. 17. Number of bricks of slane turf, and dimensions when dry, which one man can cut, on an average, per hour. 18. Standard measure employed in the district, and its dimensions. 19. Cost of cutting, wheeling, footing or drying, and clamping this quantity, stating the items separately. 20. Weight of such measure of surface turf, average brown turf, and good black turf. 21. Average price at which a ton of each of these different turfs could be delivered at the bog. 22. Cost of carriage for each kind per ton per mile. 23. Cost of making a standard measure of hand turf, stating amount of each item of expense. 24. Weight of a standard measure of hand turf, distinguishing each quality. 25. Average price at which a ton of good hand turf could be purchased on the bog. 26. Cost of transporting turf per cubic yard per mile on the Grand and Royal Canals, Newry Canal, Lagan Canal, the Barrow, the Shannon above Killaloe, the Killaloe Canal, the Suir, the Ulster Canal, &c. 27. If any, and what kind of manufacture is conducted in the district, in which turf is used as fuel. 28. Estimated cost of each kind of turf employed per ton delivered at the factory, stating distance from the bog and the sum allowed for carriage. 29. Quantity of turf consumed under steam engine boilers per horse-power per hour. 30. Weight of turf which would be considered equivalent to one ton of Newcastle or other coal, stating weight of a given measure of the turf, and the kind of coal. 31. Relative consumption of turf and coal under brewers' and distillers' coppers and stills, stating quality of turf, cost per ton at the factory, and the kind of coal with which compared, and its estimated cost in the district. 			

In order to arrive at a true estimate of the value of turf as a fuel, it will also be necessary to know the cost at which coal can be had at the different seaports of Ireland, and the cost of fuel in the different manufacturing districts of England. For this purpose we subjoin the following queries:—

32. Average price of coal at Whitehaven, Newcastle, St. Helen's, near Liverpool, (or any other of the Lancashire collieries,) South Wales collieries.

33. Cost of transport from each colliery to seaport.

34. Cost of shipment at Liverpool and the other ports, including dues.

35. Average freight per ton on coals from Whitehaven, Newcastle, Glasgow, (or other Scotch ports,) Liverpool, Swansea, or other Welsh ports, to the following Irish ports:—Belfast, Cork, Drogheda, Dublin, Galway, Limerick, Londonderry, Newry, Sligo, Tralee, Waterford, Wexford, and Youghal.

36. Port dues and charges of landing, &c., in each of these ports.

37. Average cost of coals suited for manufacturers in Bristol, Birmingham, Leeds, Manchester, Bradford, Preston, Nottingham, Warrington, &c.

38. Cost of coals on board ship in London, stating kind of coal.

39. Relative cost of coals to a manufacturer on the banks of the Thames, and to one situate two to three miles from it, distinguishing those having the facilities of water carriage.

Although the answers to many of the above queries would vary according as freights ruled, or the value of labour rose or fell, and could, in any case, be only approximative, still much relative information might be gained could satisfactory answers be obtained to the whole of them. Much may be written about the value of turf as a fuel, and many complaints made that it is not brought more into use in this country, but until a body of information shall be collected, such as would be afforded by complete answers to the preceding queries, few persons will be inclined to employ turf on a large scale, notwithstanding the absurd statements which are sometimes put forward in England about the fabulous results which might be, but, strange to say, are never, obtained by some new process for spinning or squeezing the water out of a whole peat bog.

ART. III.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

INVENTIONS AND IMPROVEMENTS IN MACHINERY AND PROCESSES EMPLOYED IN THE PREPARATION OF FLAX AND OTHER FIBRES, AND IN TEXTILE MANUFACTURES.

SERICULTURE.—*The Bombyx Cynthia, a species of Silkworm which lives upon the common Castor Oil Tree.*—It has been known for a long time that the mulberry silkworm is not the only species of silkworm bred by the peasants of India for the purpose of obtaining a textile material, and that among these species, the products of which are scarcely known in Europe, there is one especially which is the object of an important industry; namely, the *arriady arria* of the Hindoos, or the *bombyx cynthia* of entomologists. The caterpillar of this species lives upon the common castor oil tree, and the silk which it yields, although less beautiful than that of the *bombyx mori*, is very useful because of its remarkable solidity. It appears that in many parts of India it serves to produce the daily clothing of the poorer class during the

whole year, and of all classes during the cold season. According to Dr. Roxburg, one of the first authors who has made us acquainted with it, it is weak and coarse in appearance, but of an incredible durability. He says that the life of a single person is rarely sufficient to wear out a garment of this kind, so that the same article often passes from mother to daughter.

The *arrindy* is chiefly reared within doors in India, and its growth is so rapid, and the generations succeed one another within such short spaces, that ordinarily 6 or 7 broods, and even 12, of spun silk may be sometimes obtained in a year. The *palma christi*, or castor oil plant, upon the leaves of which it feeds, is easily cultivated in India, and even in France. The rapidity with which the eggs are hatched, and the metamorphoses of the insect effected, have hitherto opposed great difficulties to its introduction into Europe. Through the exertions, however, of Sir William Reid, Governor of Malta, and Mr. Paddington, some have been reared in that island, and thence propagated in some parts of Italy, chiefly through the zeal of the Abbe Baruffi, Rector of the University of Turin, and M. Bergonzi. From the latter country some eggs were sent by Professor Savi, of Pisa, to M. Decaisne, of Paris, who gave them to his colleague, M. Milne Edwards, who has succeeded in producing cocoons. The eggs of this first French brood of the *bombyx cynthia*, were sent to different sericultivators and entomologists in various parts of France, and also to Algiers.

M. Hardy, Director of the Central Nursery of Algiers, has reported upon the results obtained with those sent to Algiers, and then sums up the advantages which this species of silkworm offers for Algiers:

1. In its food consisting in the leaves of a plant which grows with the greatest facility in Algiers, and which gives abundance of leaves, thereby affording a considerable mass of food in one season for new animals. In this respect the breeding of this species may be considered as a speciality for Algiers.

2. In the property which its eggs have of being hatched almost immediately after being laid, and of thus permitting a permanent education to be made.

3. And in the fact also pointed out by M. Dumeril, that owing to the construction of the cocoons, they are of equal value after the butterfly has escaped as before, and that therefore the cocoons need not be exposed to a high heat in order to dry the chrysalis, and prevent it from completing its metamorphosis, and thus injuring the silk, as in the case of the mulberry silkworm.

In the cocoons of the *bombyx cynthia* the filaments of silk are glued together, so as to constitute a sort of fabric, with a species of gum, which the ordinary processes of reeling cannot sufficiently soften or dissolve. Owing to this the silk of this species is usually obtained in India as floss or *bourre*, and is carded and spun somewhat like cotton; but the fabric termed in Bengal, *corah*, shows that it can also be reeled and made to yield organzine and trame, or shute. M. Guérin-Meneville has made some experiments with this object by means of the new apparatus of MM. Alean and Limet, for preparing the cocoons and reeling the silk, of which we gave a notice at page 213, Vol. I. of this Journal. He has found that by using alkaline solutions, and a sufficiently long continued ebullition, the gum can be softened or dissolved, and that the filaments can then be reeled off in the ordinary way as a continuous thread. He further observes, that the process of Alean and Limet is the only one which permits of the silk being obtained from this species as a continuous filament. The silk thus obtained has a brilliant satiny lustre, and a remarkable tenuity.

M. Guérin-Meneville made an observation relative to the employment of the process of Messrs. Alean and Limet, which is of the utmost importance. It appears that in China there is a species of wild silkworm which feeds upon the leaves of the oak, and produces coarse cocoons. By means of the process alluded to, a reeled silk was obtained from them, which, aside the colour, rivalled in beauty and regularity of filament our ordinary silks. There can be no doubt that a wide field remains open in the silk trade of these countries, by importing the cocoons themselves from China and India, and applying the best and newest methods of filature practised in France, to the preparation of the raw silk. For as M. G. Meneville observes, a comparison of the raw silk, which can be prepared in China and India from the cocoons of other species than the mulberry silkworm, with what can be

prepared from the same cocoons in Europe, shows the immense superiority of our methods of filature.

Chadwick's Machine for Reeling Silk from the Cocoons.—That the idea of importing the cocoons themselves instead of the raw silk has already begun to be entertained by the silk manufacturers of England, is proved by the fact of a patent having been already taken out there for a machine for reeling the silk from the cocoons. This machine, invented by Mr. John Chadwick, a silk manufacturer of Manchester, described in a recent number of the *Artizan*, and which we believe is in actual operation, is incontestably inferior to the one of Alcan and Limet, which is equally applicable to the cocoons of any species of silkworm. Mr. Chadwick's machine possesses some advantages, which if added to the French one, would render it so perfect as to solve at once the practicability of importing cocoons on a great scale.

Mr. Chadwick's machine "consists of an iron framework about four feet wide, four feet high, and four yards long. On each side there is a row of 30 bobbins arranged vertically, about 18 inches from the floor. They are furnished with ordinary flyers for encircling them with the thread as it is produced; and to each of the sixty bobbins there is a motion by which each can be thrown out of gear, independently of the other. Over the bobbins there are on either side 30 copper troughs or basins, containing water at a temperature of about 120 degrees. In each of these troughs float six cocoons, and the silk from these 360 cocoons is drawn by very simple means. The continuous filament does not lie in circles upon the cocoon, but describes a form very similar to the figure 8 placed on the surface in a longitudinal direction, thus ∞ . As the filament is drawn off, the cocoons have a slight oscillatory motion in the water; and to keep them from entangling one another, the basins are provided with brass wires of proper shape, a little above the surface of the water. Nearly a foot above each basin there projects a wire about three inches long, covered with some soft woollen or other substance, and over this material each set of six filaments are drawn, the effect being to cleanse them from superfluous moisture, and from any impurities which may adhere to the slender thread. To effect this object, the throwster (in a second stage) resorts to a special winding, the thread being drawn through a groove. Since, however, it is then in a dry state, the slight impurities are not likely to be so easily removed from the fragile filament as when it is moist. After descending from the cleansing part, the six filaments pass through a small curve made of glass, and are received by the flyers and spun upon the revolving bobbins. By this treatment the winding into hanks, as performed by the silk growers abroad, the winding on bobbins from the hank, and also the cleansing process, as heretofore performed in England by the throwster, are entirely dispensed with; a perfect thread of silk twisted or spun being furnished at one operation, so that if the silk be intended for orgazine or warp, it only requires the further process of doubling and throwing; but if for trame silk, one process is sufficient, as thread can be easily varied in thickness, by simply increasing or decreasing the number of cocoons placed in the basin."

"One young girl can easily superintend 30 troughs, and a continuous thread can be produced to fill a bobbin, free from knots or piecings; for as any single filament breaks, the new end has simply to be placed in contact with the other five, and becomes one with the thread; and as the cocoons end at different places, the whole is produced in the same number of fibres. A bobbin of China silk was inspected of double the fineness of any China silk imported, equal to the finest French thrown silk, and calculated to be worth more by 8s. or 10s. per pound than the same kind of silk would have been if reeled from the cocoons in China."

Previous to reeling the cocoons undergo a certain preparation: "They are placed for a few minutes in a solution of soap and hot water. By means of a perforated lulle they are then removed to an adjoining trough of warm water, and here with surprising facility, the principal end of the silk on each cocoon is found by the hand of the girl who discharges that duty. The water detaches the end, and she catches it from the floating surface, sometimes taking up half a dozen such ends of silk at a time. A little is drawn off, and then these cocoons are placed in a basin, the ends hanging over the side. The two girls who superintend the reeling, fetch them as they may be required, and place them in a trough at the end of the reeling

frame, from which they remove them to the respective basins, to substitute the cocoons as they become exhausted of silk. The apparatus strips the silk very perfectly, in fact, down to the thin covering which encloses the chrysalis. It is stated that four pounds weight of cocoons abroad or in France (where reeling has been performed for a few years with an instrument nearly the size of this for two sets of cocoons) will produce one pound of silk, but that by this process more than one pound weight is obtained. A new channel in the business will require to be opened—that of importing the cocoons. These have never been supplied, because they have never been demanded; but we suppose they would follow the usual law in this respect which rules other merchandize, and find their way to a good market."

It is further stated, that the silk made by this machine is of twice the fineness of the China silk which is usually imported, and that there is less refuse than by the hand process, or by another apparatus which has been in use for two years in France, meaning, we suppose, that of Messrs. Alcan and Limet. If this be the apparatus meant, we certainly doubt the correctness of the statement, as will every one who compares the processes. Mr. Chadwick, it appears, claims the entire ground of reeling the silk direct from the cocoons; he might as well have at once claimed the discovery of silk. The error of claiming too much in a patent is a mistake, and we are much surprised that the author of a really genuine improvement like that of Mr. Chadwick, should commit such an error.

Cotton Heckler—A new machine has been introduced by J. W. Crenshaw, of the Bluff City mills, Memphis, Tennessee, for preparing and cleaning cotton from the bale preparatory to carding, which, he states, requires less power than winnowers, breaks the staple less, and cleans far better. It consists of a number of saws 10 inches in diameter, each placed $\frac{3}{4}$ of an inch apart, which run 1,000 revolutions per minute. A brush wheel located nearly on the top of the saws making 1,500 revolutions per minute, removes the cleaned cotton and blows it to any part desired like a cotton gin. The saws receive the cotton from fluted rollers—the cotton being fed in on an endless apron. The process is that of ginning the bale cotton instead of employing the machine now used for preparing bale cotton in factories, and which is vulgarly named a "devil."—*Scientific American*.

JOURNAL OF SOCIAL PROGRESS.

ART. I.—ON THE INDUSTRIAL INSTITUTIONS OF BELGIUM. NO. I.—*On the Ecoles d'Apprentissage (Apprenticeship Schools)*.

HISTORICAL INTRODUCTION.

"AMONG the nations who at the present moment dispute the palm of pre-eminence in commerce, in civilization, and in the arts," says M. Briavoinne, with great truth, in his valuable work on the Industry of Belgium,* of which we shall make large use in the present paper, "there are few as to which ancient history gives us more abundant information than that of the Belgians. There is none which more forcibly inspires us with a sentiment of the respect which we owe to past ages.

* De l'Industrie en Belgique : Causes de décadence et de prospérité : sa situation actuelle. Par M. N. BRIAVOINNE. Bruxelles : 1839.

Place yourself in the midst of this flourishing country; look into the past; how far back soever your eye can reach, you may be certain of meeting traces of active and able Industry. Again and again in its alternative progress, from North to South and from South to North, a great current of mankind has altered and renewed the races which have occupied these countries. The Celts, the Germans, the Romans, the Franks, the Saxons, settled there; the spirit of the country has remained the same; it has bent itself unceasingly to Labour; it has almost always sought its glory in conquering a rebellious climate and soil."

The history of such a nation should afford pregnant examples to every people who possess the faculty or the opportunities of industrial exertion; and in selecting for the subject of the present papers a few of its numerous practical institutions to hold up to the imitation of our own countrymen, we gladly take the opportunity of recommending for their study the whole story of the gradual rise and eventual success of industrial enterprise in Belgium, victorious as it has been in the end over difficulties and impediments almost identical with those which have proved up to the present time too much for less fortunate Ireland. It needs but little acuteness to recognize the same social and political misfortunes in the Belgium of the 16th and 17th centuries, and the Ireland of the 18th and 19th, and it needs no magic of philosophy to conclude that the only remedy must also be the same. For our present purpose, however, it is but necessary to recall to the recollection of our readers some of the more remarkable events of Belgian history immediately affecting the progress of its manufacturing Industry, and out of which the principles of its industrial institutions took their rise: and this we must attempt to do in the shortest possible space. The most complete information upon the subject, both in a practical and a philosophical point of view, may, however, be obtained by consulting the works (all of them easily enough accessible) referred to in that above quoted.

The dawn of Belgian industry may be perceived in the pages of Julius Cæsar himself. Above half a century B.C., Cæsar found the Belgian provinces occupied by a population partly indeed nomadic in its habits, but almost in every direction presenting particular examples of a stationary and regularly constituted society, where in favourable localities men assembled and settled under regular chiefs, and in obedience to regular laws, for the exercise of the useful arts. Even at this time these populations appear to have possessed arms, clothes, and carriages, superior in workmanship, in design, and in ornament, and proving the existence of many trades (and several of these devoted to the production of mere luxuries), in the exercise of which they had already made themselves remarkable, even before their contact with Roman civilization. After the conquest, and throughout all the period of the government of these countries by the Romans, many public improvements were continually effected, by the construction of public buildings, magazines, aqueducts, baths, canals, and water works; and the Roman emperors constantly encouraged the industrial arts among a people so much disposed to the peaceful exercise of them, by making industry and commerce the road to special rewards, public honours, decorations,

and privileges. So soon as within three quarters of a century A.C. the Belgian provinces had thus become "powerful" and "rich," according to the testimony of Tacitus.

When the Roman power succumbed to the continual attacks, first of the Franks and then of the other tribes which poured across the frontiers of the western portion of the empire from the centre of Europe, the Belgians did not receive and were not treated by the invaders altogether as enemies, for the remembrance of their ancient affinity in race was not obliterated: the progress, therefore, of mutual civilization was not materially checked during a period of transition much less violent than it is generally supposed to have been; and in some of the sepulchral monuments, not yet lost, of the age immediately succeeding, remarkable proofs of skill in manufacture still exist. The salique laws of the Franks contain evidence of the existence of regular trades, (the iron worker, the gold worker, and all the other ordinary trades,) as well as of that of water-mills, and other civilized appliances; and it would seem, indeed, that the mechanical arts ever received the greatest encouragement from the Frankish kings, a material circumstance when it is remembered that, during the earlier ages of the Frankish or French monarchy, its seat was in the country of Belgium (at Tournay). Again, the ecclesiastical establishments, which became numerous in Belgium from the earliest period of Christianity in the north of Europe, materially assisted in giving an impulse in the same direction. Attracted by the great richness of the soil, religious communities settled in many parts of fertile Flanders, and it was around their settlements, or under their immediate influence (an influence which, be it remarked, constantly encouraged the ornamental arts, and by direct teaching as well as by patronage), that some of the chief cities, such as Ghent, Mons, Brussels, and Liège, grew into existence.

The paternal government of Charlemagne, the greatest mind of the middle ages—Charlemagne himself a Belgian—gave new protection and development to the arts of peace, after he had succeeded in restoring the royal power, which had been set at naught during the age preceding his by the turbulence and lawlessness of the petty chiefs of the country. Charlemagne not only encouraged agriculture, but he extended the commerce of Belgium; he introduced into Flanders colonies of better educated industrial people from other nations; and he established a system of wise laws for the restriction of arbitrary taxation, and the encouragement of trade. Accordingly, at the beginning of the 9th century, the country began to show general signs of commercial and industrial activity, and among other things in the growth of many new cities and towns which sprang into existence in consequence of the impetus given by the institutions of the ablest of the mediæval princes. In the following age (in the reign and under the protecting conduct of Baudouin III., one of the most remarkable civilizers of his epoch), Belgium devoted itself to industrial exertion, almost alone among the nations of Europe, all the rest of whom were at this time too constantly plunged in wars and distracted by the ambitious rule of rival leaders, equally brutal and absolute, to cultivate the peaceful arts of civilization.

The consequence of these habits of commercial enterprise, becomes especially manifest during the Crusades (1095 to 1300), in which Belgian leaders (like Godefroid and Baudouin) became kings of Jerusalem, and even Emperors of Constantinople. Accustomed to trading excursions, the Belgian expeditions generally proceeded to the Holy Land in Belgian ships, making the voyage round the coasts of France and Spain, and through the straits of Gibraltar; while their more powerful, but less civilized neighbours of Germany and France, found it necessary to march by land to the Mediterranean, and to embark in vessels hired from Venice or Genoa. The wealth of the country in these times is recorded in connection with the splendid but solid equipment of their armies in the east, which were besides more numerous, and more frequent in proportion, than those of any other of the Crusaders. And during these same centuries, Belgium was no less remarkable for expeditions of a more peaceable character. Bremen, Westphalia, Saxony, the Schwartzenburg, Brandenburg, Prussia, Pomerania, successively sought the aid of Belgian skill in the construction of dykes, in the improvement of the land, and in the introduction of manufactures. At this time the rest of Europe, more exhausted of its resources, because less industrious and less provident, stood in need of supplies of corn, flax, wool, linen, cloth, and many other objects of the most necessary kind. Belgium seized upon the opportunity to extend its trade, and its commerce became extensive in Germany, in England, and even as far as Portugal itself. About the same time too, it set the example to the rest of Europe, of organizing a regular trade with the Arabs, and introducing the products of Asia into the Western markets. The jealousy and intrigues of England and other neighbouring countries were in these days easily vanquished, because the power of the people was undivided, and ready to be exercised at all times, for the force of public opinion was strong, and the national confidence unbounded. The merchants of Belgium, indeed, even in these feudal times, enjoyed, we are told, all the social rank really due to citizens so useful. No office in the state was above their reach, and their sons sought for no "patents of nobility," and did not disdain to follow quietly the occupation of their ancestors.

The great fault of a too exclusively commercial system, however, soon produced its effect: that selfishness which is inseparable from the too ardent pursuit of mere gain, entered into the hearts of this merchant people, and province eagerly rivalled province, and city, city, till at last they forgot their allegiance to the principles of a common nationality, and contended against each other with a bitterness of ignorant fury which soon sapped to its foundation the strength of the whole nation, and prepared for the too rapid decline of its prosperity and power. The ruin of the once powerful cities of Ypres, Louvain, Ghent, and Bruges, (in the 13th century boasting of populations from 150,000 to 200,000 souls each,) may be traced to this cause; their contentions, of course, fostered and assisted by the countenance and arms of neighbouring rivals interested in the destruction of the Belgian commercial supremacy. The age of the Artevelde followed—the Artevelde, whose ambition the national writers of Belgium bitterly accuse of a priu-

cipal share in their country's ruin, and in nothing more bitterly than in their intrigues with England, which was but too glad to take a gratuitous part in the work of disorganization, and to which this family endeavoured to hand over even all Flanders itself, as the price of political friendship. Amidst such troubles the best artizans of Belgium and Flanders took refuge in other countries, to pursue their trades in peace, and England, France, and Germany, profited during several generations by their constant emigrations from a too troubled home.

In the 16th century, however, the rule of the great Emperor Charles V., himself a native of Ghent (born there 24th February, 1500), brought better order into the distracted affairs of Belgium. He repressed with a strong hand the turbulence of the great cities, and did not hesitate to lean very severely even upon his native Ghent. He sought to inspire the whole people with a truer sentiment of its unity, and thus to harmonize the various provinces and cities of Belgium into one powerful and compact nation; and he would have made it a great nation of itself, if his wars with France, in other interests than those of Belgium, had not hindered the most natural development of Belgian commerce, and his consequent fear of the hostility of England had not prevented his taking energetic measures against the most constant and dangerous enemies of Belgian prosperity. Charles V., however, took many energetic measures for the encouragement of Belgian industry, commerce, and manufacturing and agricultural industry, and he paid especial attention to its shipping interests, not only by the construction of vessels, but by the protection and extension of its fisheries, which he rightly described as "so important a branch of the revenues of Flanders." His successful exertions to centralize the power, by centralizing the institutions of these provinces, by adding to the strength of the whole gave greater force and consistence to those measures, and he left Belgium in a state so much more advanced than when he succeeded to its government, that he has been justly considered a benefactor to his country.

The industrial history of Belgium, then, presents on the whole, and notwithstanding many troubles, a satisfactory picture of progress from the 11th to the 16th century. From before the era of the first Crusades the Belgians had not only distinguished themselves in wealth and commercial prosperity, but they had led the march of improvement in western Europe, by supplying the neighbouring nations with intelligence in the persons of skilled artizans, as well as with superior productions of inventions and manufacture. The coal works in the country round Liège date from 1198 to 1213. Marine assurances were established in Brussels in 1311. The trade in barrelled herrings was set on foot by Kien of Ostende in the early years of the 15th century. Painting on glass is believed to have been discovered in Belgium about the same time. Oil painting was used by John Van Eyck (a native of Maseick) in 1410. Printing, which in a rude state had already been successfully attempted in Antwerp in the 14th century, was practised with moveable types in Alost, Louvain, Antwerp, Bruges, and Brussels, so early as from 1473 to 1476. It was Beham of Bruges, who in 1449, (long before Columbus,) discovered the Azores; and the great geographers of the 16th century, Ortelius and Mercator, were

Belgians. So great was the activity of this people in every department even in these troubled times.

The commercial institutions of Belgium necessarily grew up rapidly in the midst of so much commercial activity. The organization of trades in regular corporations, existed in the 12th and 13th centuries, and reached its full development in the 14th. This organization appeared to have been preceded by (and was perhaps an adaptation of) the schools or colleges of arts and trades established by the Romans, of which records exist at Lyons and other places throughout Roman Gaul. During the time of the Crusades, the cities and towns formed themselves into Communes; and Belgium was the first to establish its *Gnilds*, or armed confraternities of artizans, banded and exercised for the purpose of being able to protect themselves, and to defend their cities against the oppression of the feudal chiefs and the robberies of the so-called nobles. These institutions became many of them useless, and even injurious, in process of time, as abuses crept into the working of them; but while we approve of the spirit which swept them utterly away during the revolutionary times of sixty years since, let us recognise in them also a certain fitness for the circumstances in which and for which they were originally devised, and admit that they contributed materially to that early prosperity, the recollection of which has been so potent as to raise Belgium again in our own day to the rank of a nation. "One other trait, too," says M. Briavoinne, in the work before quoted, "characterises the Belgians under the Dukes of Burgundy and Charles V.; they constituted a society at once Catholic and Industrious. Certain writers, nevertheless, witnesses of the progress which one or two European nations then made in riches and industry at the same moment that they adopted the principles of the 'Reformation,' have expressed a general opinion that the Protestant religion is more favourable to industry than the Catholic. The example of the Belgian people proves this conclusion to be somewhat too absolute, for there is none that has remained more constant in its devotion at once to its ancient religious Faith and to its instinctive habits of industry;" an observation, the truth of which is unquestionable, and which suggests a train of thought not without practical value in its application to our own country of Ireland also.

The beneficial influence of the rule of Charles the Fifth seems to have depended on his personal character, power, and ability. The decline of Belgian prosperity dates from the accession of Philip II. in 1555, and continues rapidly to increase throughout the whole period of the Spanish rule until the Peace of Utrecht, in 1713. Torn asunder by foreign and civil wars, and for ever sacrificed to the ignorance of Spanish ministers,—and to the unvarying principle of Spanish policy: to make use of this distant province on all occasions when any advantage was to be gained in Spanish politics, by the sacrifice of mere Belgian interests, or even the cession of its soil,—Belgium gradually lost, during this disastrous period, a great part of its territory, and the wealth and trade of many of its most important cities. In the north, the Dutch provinces became a Batavian republic; in the west and south, a part of Hainault, of the Ardennes, of

Artois and of Flanders, were absorbed into the French monarchy; while by degrees the naval power and commerce of Belgium were on the one hand crippled, nay almost destroyed, by French and English force, and on the other, fettered and discouraged by Spanish treaties for the satisfaction of Prussia and Holland. Amidst such difficulties and misfortunes, which it was out of their power to contend against, the moral energy of the people gradually gave way. The emigration of the artizans, always encouraged by the pressing invitations and rich rewards of neighbouring nations, received a new impetus from the misgovernment which ruled at home; and Schiller computes the loss of population suffered during this epoch by the Catholic Low Countries at a million of subjects. The emigrants contributed largely to the growing wealth of Holland, introduced the most valuable arts into England, and again established new settlements of industry in the chief cities of Germany and France; thus not only diminishing the strength of their own country, but increasing that of their neighbours, and literally placing weapons in the hands of their most powerful rivals in commerce and manufactures.

The exertions of England were always directed in the case of Belgium, as of other nations smaller than itself, to check by force that commercial development which it was unable by fair means to outstrip or rival. The principles of "free trade" it was not yet convenient to adopt, and from the 13th to the 18th and 19th centuries the commerce and manufactures of England were very wisely and very effectively fostered by a constant course of "protection." But the government of England did not always stop there; its policy was almost as uniformly (if we may believe the most authentic writers on continental trade) to cripple the prosperity of its rivals by all the means which the resources of force or diplomacy, of quiet intrigue or open war, might supply. The bitter complaints with which, in our own days—long after Belgian prosperity had again revived, and it needed no longer to fear the neighbourhood of England—Belgian historians trace out that policy, suggest many a severe practical comment upon the philosophical "principles" so dogmatically laid down by certain popular schools of politicians in the present generation.

In the 13th century, King Edward of England endeavoured to injure the Flemish woollen manufacture, by preventing the exportation of English wool; Belgian power and public opinion being, however, then at its height, popular reprisals promptly made, obliged him to reverse his decree, and Belgium even gained the additional advantage of free fishery on the English coast. In the 14th century (1383) we find the English actively assisting Ghent to ruin and destroy the great trading city of Ypres. After this the Artevelde were chiefly supported by the same influence. In the 15th century, and during the whole period of its rise, its prosperity, and subsequent decline, every effort of diplomatic ingenuity was put in force (and often with success) to impede the trade of Antwerp, and to foment the contentions existing between that and the other great towns of the Low Countries. At the close of the 16th century, England and France were actively engaged in the destruction and appropriation of Belgian merchant vessels and their cargoes, and energetically assisted Holland in its design

to ruin for ever her mercantile enterprize, Even in times of peace the same system was pursued.*

The hostility of Holland was more intense, but it was more natural, and the violent means which that people employed against their former fellow subjects were to a great degree justified by the necessities of their position. The decline of the Catholic provinces, arising from the various causes we have touched on, was itself directly the origin of the sudden prosperity of the Protestant Low Countries: the latter gained precisely in proportion to the losses of the former; and thus it was that there arose between the two people a profound diversity of opinion and of sentiments. If the system of politics adopted from the moment of their enfranchisement by the United Provinces, says M. Briavoinne, was able, it was above all unpying and inexorable: enemies of Spain *à l'outrance*, (for the question was one to them almost of existence,) they were forced to destroy her power wherever it appeared, and Belgium, their nearest neighbour, belonged to Spain. A commercial nation, then, they naturally directed their principal efforts towards the ruin of Belgian commerce, and favored by the political circumstances of the times they did so for several generations with almost unvarying success. At length the treaty of Munster, in 1648, (in which Belgian interests were sacrificed in a more wholesale manner than ever before to the demands of Holland, in order to detach that power from a French alliance,) formally prohibited the trade of Antwerp, the chief city, by closing to Belgium its chief river, the Scheldt; directly favoured the trade of Holland by arbitrary enactments, securing to it the monopoly of supply in many even of the most necessary articles of life; and struck a blow at the commercial enterprize of the weaker nation, by suppressing the India trade of the Belgian provinces. By the treaty of 1659, on the other hand, the great town and port of Dunkerque was for ever ceded to the French, actually because its value, perhaps even its existence, was unknown to the Spanish ministers in Madrid, who ruled the destinies of the distant "provinces."

It was thus that the decline of Belgium ever rapidly advanced; but it is remarkable that the national instinct for labour survived the temporary extinction of national sentiment in politics. Every interval of comparative peace brought with it an immediate revival of industrial activity, though often merely local, often merely confined within the limits of a single fortified city. And even the epoch of decline (1555-1713) is marked by the discovery of many of the most useful instruments of science, (such as

* The commercial system of England, according to Renom de France, consisted of three principal points: to have a great number of well equipped ships of war and able sailors; to attract to itself the navigation of the world, both in import and export trade, to the exclusion of all strangers; to ruin and destroy the navies and maritime commerce of its neighbours. One single fact, adds the historian, will give an idea of the morality of this government: a convoy of specie having been despatched from Spain to Flanders, Queen Elizabeth gave orders to seize upon it, and it was actually carried a prize into the English ports. Philip II. demanded its restoration; but Elizabeth answered that she was told the treasure belonged to merchants, and she promised to pay interest on it! Yet Elizabeth was then at peace with Spain and the Catholic Low Countries

the telescope, at Middelbourg, in 1590), and the material improvement of many of the most important discoveries in the useful arts.

The transfer of Belgium to the rule of Austria, (the consequence of the Battle of Ramillies in 1706,) began a new era in the history of the country, not indeed at first productive of any improvement in its commercial position, but already preparing the way, by a milder and more attentive internal administration, for the Revival of the years following the peace of Aix-la-Chapelle, in 1748. By the Barrier Treaty (1715), which secured its new possession to Austria, the bitter articles of that of Munster were ratified and preserved; but the Austrian authorities only a few years afterwards, in authorising the establishment of an India Company at Ostende, gave substantial proof of the desire of that government to construe its restrictions as liberally as possible to the profit of the Belgian provinces. The Ostende company was established in 1722, with a capital of six millions of florins, and its establishment was not merely important in respect of the India trade, great as that would have necessarily been when carried on on such a scale, but also in the prodigious impulse which it instantly gave to the long kept down commercial energies of the country. The capital of the new company was at once subscribed, and the activity which was excited by its trading expeditions extended to almost every department of Belgian industry; among others, to the revival of the Fisheries, in which Charles the Fifth had so early recognised a chief source of the wealth of Flanders, and which had fallen into neglect during the period of political depression. But Holland soon grew seriously uneasy, and negotiations were opened on foot of the stipulations of the fatal treaty of Munster, in consequence of which the suspension of the Company was decreed in 1727, and in 1731 it was finally suppressed. With it fell several Fishery Companies which had started up at the same time. The commercial enterprise of the nation which had been suddenly awakened, as suddenly disappeared altogether; and the Belgian people were consoled in Holland by an assurance (marvellously like that with which their neighbours nearer home have been in the habit of comforting another people, whose trade was also systematically suppressed, just as the trade of Belgium was) that "Belgians were not fit for Commerce and Manufacture," and that Belgium was quite intended by nature to be a "purely Agricultural country."

The agriculture of Belgium, however, excellent as it was, could not feed the abundant population, and another course of emigration (as usual of the ablest and most skilful) was the result. In the mean time those that remained were not idle, and, in the midst of discouragements of all sorts, inventions and improvements in mining and manufactures still continued to foster the dreams of a future national prosperity. Before 1730, the steam-engine (as then known) was introduced in the coal mines, first in the district of Liège, then in the Hainault. Almost the same time Boneval established tin and steel works at Namur. In 1726, Meens obtained permission to construct an establishment for calico printing, like those already carried on in Holland. Thus industry still struggled on in spite of foreign obstruction, and the incubus of an evil government at home.

At last the Low Countries passed under the rule of Prince Charles of Lorraine, in 1741, and, after some years of war, the long continued troubles of Belgium were terminated by the peace of Aix-la-Chapelle in 1748, the first treaty, for ages, in which her interests had not been sacrificed. From this event dates the revival of Belgian industry, and with it the decline of Holland. The prosperity of the former appears to be due to the simple and honorable character, and the enlightened intellect of Prince Charles, who perfectly understood the value of the nation's commerce, and its peculiar aptitude for industrial success, and from the first applied himself to its protection and encouragement. The depression to which he found the country reduced on his accession to the government, required some impetus to trade at the hands of a just and paternal ruler; he gave it the necessary encouragement at once, and devoted his reign to its assiduous protection. The golden age of Belgian industry thus commenced accordingly with the peace of 1748, and it continued undisturbed until the revolutions of Brabant, in 1787, that is, throughout nearly forty years. The public tranquillity remained, in fact, undisturbed during that long period, and the national prosperity extended to commerce and to the fisheries, as well as to every department of manufacturing industry; a prosperity attested by the most unmistakeable facts:—an increased population, a constant improvement in the customs revenue, and an abundance of monied capital.

The system pursued by the government of Prince Charles was not merely that of encouraging agricultural improvements and the establishment of local manufactures in the Belgian provinces; its principal feature consisted in providing a ready home market for the productions of the country, until they should be able to compete freely abroad as well as at home with those of the neighbouring nations to whose prosperity they had been for so many years forcibly sacrificed. This government directed its energies, above all, to resist the influence of Holland and of England, and it was successful, because it was but just, because it was as moderate as it was firm. The principle of a wise and timely Protection to infant commerce, by means of customs duties, had already been successfully introduced by Charles the Fifth in contact with Venice. It had been practised against Belgium by Holland in 1625, and by England for above a century, but particularly since 1688. During the wise administration of Cobenzl (the Belgian Colbert), from 1753 to 1770, a system of *ad valorem* duties was accordingly imposed upon the importation of manufactures, which, till then, had injuriously competed with those of Belgium, and these duties were retained, modified, or removed, according as the revival of Belgian manufacturing industry made it advisable, until free competition could no longer be an injury to the nation. That the measures of Protection, so carried out, during the period referred to, were moderate, beneficial, and wise, even that they were necessary at the time, is proved by the result, and by the fact, that the customs revenue increased largely just when the duties imposed were highest in amount; for the rest, we know that the previous experience of those countries, which at the present day are most benefitted by "free trade," has been precisely the same,

and that it is but the injudicious retention of a high tariff after it has become unnecessary, and not the Protection itself, that is contrary to philosophical principles.

The tendency of the Belgian people always led them to pay but little regard to politics; and, provided they could enjoy peace, and their industry reasonable encouragement and fair play, they cared but little about the conduct of their rulers. Their ideas of personal and commercial liberty were, however, at a very early period, of an advanced character; and slow to admit any change in their constitutional life, they were always obstinate in defending it intact against the designs, whether well or ill intentioned, of their own rulers, as well as against the attacks of foreign power. According to their ancient constitution, the Belgians always insisted that their country was "not subject to Taxation, but only to Subsidy, at the hands of the government;" and although the prince enjoyed the sole legislative power, he could enjoy it, in the most necessary matters, only after consulting the Provincial Estates. The different provinces also enjoyed peculiar forms and privileges, such as the "*Joyeuse Entrée*" of Brabant and Limbourg, &c.; and all these constitutions, preserving in a more or less perfect form the principle of representation, were jealously guarded by the people. The court of Austria thought fit to assume to itself, towards the close of the last century, the power of imposing taxes upon the provinces, without asking for their consent. Such an assumption, as long as, under the administration of so benevolent and conciliatory a governor as Prince Charles, it existed only in theory, and no attempt was made to put it in practice, did not rouse the hostility of the people, it continued secure in the certainty of its rights. But, after peace of nearly forty years, the Austrian government found it convenient to levy additional taxes, and the Belgians, even of that day, instantly proved themselves as ready for insurrection as at any time their ancestors had been, in defence of their national constitution and ancient privileges.

Prince Charles died in 1780; Joseph II. at the same time succeeded Maria-Theresa on the throne of Austria. Now like many other sovereigns from time to time, it was the special ambition of Joseph II. to go down to posterity with the reputation of a "philosopher;" and accordingly Joseph II. had his cut and dry "principles of government," with which he was resolved to commence the philosophers' millennium within the Austrian Empire at least, and which, in the plenitude of his Imperial Will, he supposed his smallest word might suffice to enact within the mere provinces of Belgium. No Austrian could, if any indeed dared, disabuse him of so absurd a presumption, and he proceeded to fulminate his edicts in rapid succession, without condescending to consider a moment how they might be received. These edicts touched on no less important matters than the repression of the liberty of the priests, (in an almost exclusively Catholic country,) the interference with the religious practices of the people, with the powers and control of the magistracy, with the territorial distribution of the governmental and administrative system, even the separate existence (not to speak of the constitutional privileges) of the

several provinces themselves. The country was naturally alarmed; the exclusive interests of trade and commerce were forgotten for the time; remonstrance followed remonstrance; *émeute, émeute*; till, in 1787, (two years yet before the French Revolution began,) the Provinces refused the subsidies required by Austria, and at last the Austrian administration itself fell prostrate, and a parliamentary provisional government assumed the reins of power. The "golden age" of Belgian Industry thus prematurely terminated, even before the country became a prey to the wars of the great European Revolution: it had sprung into existence under the influence of the same government which so soon hurried it to ruin; the idea of Austria was then, as it always has been, to encourage indeed the material and mercantile prosperity of the nations under her sway, but only at the expense of their political and personal freedom, and as Belgium never intended to accept it on such terms, she lost the encouragement of the government, in insisting on her rights as a people.

Within the ten years of Joseph's reign, the impulse given to Belgian trade by the government of Prince Charles was not intentionally counteracted by the new administration; on the contrary, the Emperor in pursuing his egotistical dream of "philosophy," rather desired to preserve than to destroy the commercial system of Cobenzl. The new ideas of England and France on the subject of protection and free trade had, however, made some way among "philosophical" speculators, (the theoretical political economists of those days,) in Belgium as well as at Vienna; and even born Belgians,—customs employés of Austria, it must be admitted,—were found, like M. Gruyer, to urge gravely, that Belgium could only be considered as a country suitable for agricultural prosperity, and for the mere working of its mines and coal beds: and therefore that its manufactures would be very wisely discouraged, and that nothing should be done to give impulse to its marine. The school of innovators (inspired by foreign ideas) ventured to reproach the Belgian people with remaining stationary for want of energy and business-like power of application; they recommended free trade, and the importation of foreign enterprise (English, for example), as a means of wakening up the nation, and teaching it how to work. Of course they lost sight of all the proofs of business capacity which Belgians had so long and so often afforded to the world, and equally ignored the train of injuries which, for two centuries, had in so many ways so effectually checked the development of Belgian commerce and manufactures. This foreign party had influence enough to make itself felt at Vienna, and the philosophic Emperor was induced once at least to make an experiment in the wrong direction, by according a free trade in grain, in 1786, an experiment ushered in by a pompous decree pretending to instruct men in the "philosophical principles" upon which it was founded. However, the popular feeling became too unequivocally marked on the subject, and the Emperor was obliged to revoke his edict the very next year. After this he did not interfere in this department again, save to increase the stringency of the protective measures of his predecessor.

One of the first steps of the Provincial States General of Brabant, after

they became possessed of the sovereign power in 1789, was to examine the industrial situation of the country, and the causes of its long decline; for even a forty years peace had only begun to establish that public confidence which must ever precede healthy commercial activity. The return of the Austrian Government to power in 1790, did not allow time for the completion of the inquiry, nor was that government ever so securely re-established during its short revival till 1792, (until the breaking out of the war,) as to be able to repair the mistakes which the Emperor's loved innovation had occasioned.

Ten years thus then sufficed again to destroy the Industry of Belgium; and the active results of forty years of mild and peaceful government were totally swept away. In 1795, when Belgium was united to France, her external outlets were lost; her internal consumption was stopped; her capital had disappeared; her workshops were closed; and military requisitions, the wasting of the country, the famine of 1794. and the invasion of the assignats. or false paper currency of France, had completed her ruin for ever, if (says M. Briavoinne) the riches of her soil and the perseverance of her people had not been absolutely inexhaustible.

The union of Belgium to the French Republic in 1795 was by no means in accordance with the wishes of her inhabitants. The Spanish administration of the country during the 17th century had made a shameless traffic in the rights of Belgian commerce, and even of its territory; it had necessarily obliterated the public spirit of the provinces. The Austrian administration had done nothing to revive it; it had, on the contrary, always endeavoured to make the people forget the very existence of their ancient political institutions, and it had everywhere repressed what of military character it found among them. When the war of 1792 broke out, therefore, the nation felt no interest in opposing an invasion which promised, at least, to give free scope to thought, and seemed likely to afford opportunities for the people to recover some substantial share of their early political independence and commercial prosperity. That Belgium, however, was by no means dazzled by the brilliant theories of human happiness held out in the great French Revolution—that it was even rather more inclined to preserve its connection with its existing rulers, provided only its ancient constitutions were respected, and it were allowed to apply itself steadily again, without interference or control, to the peaceful arts of industry, in which it felt its mission truly lay,—is proved by the evidence of many French Republican witnesses, who had felt the popular pulse of the country in the purely French interest, as well as by many public acts and documents. However, the irregular pillage to which the Provinces were then for some years subject, and the misery which an entire cessation of industry had occasioned, made the bulk of the wearied people prefer at this time the quiet condition of a conquered country to a continued struggle, the result of which they could not fathom; and accordingly, notwithstanding some partial resistance, Belgium was formally united to the French Republic by the decree of 9th Vendemiaire, in the Year IV., (1 October, 1795,) and resigned itself to its fate.

In the same year, as it fell out, the war ceased so far as Belgium was concerned after the treaty of Bâle; and in two years afterwards the treaty of Campo-Formio allowed all Europe to turn its attention to the revival of neglected Industry. Men of science and manufactures, classes previously isolated, united their studies and their exertions, and thus commenced throughout the Continent what has been truly called an industrial revolution. Of such a revolution Belgium was, by its previous education, habits, and traditions, best fitted to win the earliest and richest fruits, and to Belgium accordingly it brought at once an abundant accession of wealth and prosperity. The productive power of a people, observes the author, before so often quoted, springs yet more from its practical experience and from its moral and industrious habits, than from the richness of its soil: and in 1795 it is clearly established, upon the most emphatic French evidence, that Belgium was, in both respects, great in advance of the French of that day. It is not therefore surprising, that in the several successive expositions of manufactures held in Paris between 1795 and 1810, the chief prizes in the most important departments are recorded as having been won by Belgian houses. The government of the Consulate moreover, under Napoleon, largely encouraged the introduction of new branches of industry and the invention and improvement of machinery in Belgium, by magnificent premiums;* and Napoleon himself, when he visited the country for the first time, (Messidor and Thermidor, Year XI.) paid the most minute personal attention to the details of the factories in the principal cities, an attention generally pregnant with direct and important results, and which has never since been forgotten by the working classes. To the same government, and to the same visit, because to the very eyes of Napoleon himself, Belgium owes too the most solid and the most important works which have contributed to the convenience and prosperity of her people at large, and to the adornment of her principal towns. From the magnificent docks and port of Antwerp, and the improved harbours of Ostende, Nieuport, and Blankenburg, to the cannon foundry of Liège, and from the Northern canal connecting the Rhine and Scheldt, that of St. Quentin connecting the Scheldt and Seine, and that of Brussels and Charleroi, to the plan of the Boulevards of Brussels—all these and many other similar public works of the most extensive and important character, originating in the suggestions of Napoleon himself, sprang from the connection of the country with so great, so powerful, and so active a neighbour as France, and all have continued largely, to add to the permanent prosperity of Belgium.

Under the same rule, and inspired by the same master mind, a social impetus was at the same time given to successful industry, by recognizing it as deserving of social public honour. Cities, like Ghent, voted medals of gold, more honourable than the ribbons of courtly "orders," to such public benefactors as Liéven Bauwens, for the establishment of new manufactures, and the creation of new trades within their walls. Societies

* In this, as in most other organizing schemes, Napoleon, it must be confessed, merely borrowed and appropriated the ideas of his republican predecessors, and in many instances only continued what had been commenced in the less auspicious times of the first years of the Republic.

for the encouragement respectively of **Manufactures** and **Agriculture** were founded in every department, each one destined to be a centre of enlightened improvement, each one charged to bring to the notice of the government, and of the public, every individual who should make himself useful to his fellow citizens.

Education also occupied the closest attention of the French government; and if the pressure of absorbing political action had not monopolized the attention of the administration, the magnificent schemes of industrial as well as general education, which formed the subjects of several formal decrees, would have been soon carried into practice in Belgium, as well as in the native provinces of the French Republic. A special system of Industrial Education was in fact commenced by the establishment of two practical Mining Schools at Pézay and Geislautern, with the object of teaching theoretically the art of extracting minerals from the ore, and the preparation of metals. Schools of arts and trades (*d'arts et métiers*) were founded for the training of smiths, of carpenters, of artisans of every kind, and teaching them geometry, physics, chemistry, and mechanics. In Paris, at the *Conservatoire des Arts et Métiers*, (established to form a museum of mechanical inventions and improvements,) a course of drawing and descriptive geometry was instituted, as well as a school for spinning, and one for the higher branches of clock-making. In Belgium, at the same time, attention was paid to another class of schools, (long before encouraged by the Emperor Charles V.) those namely, where children of both sexes received practical lessons in the different trades and employments for which they were intended. At Bruges, in 1804, the Prefect of the Lys made note of a great number of schools of this kind, where manual occupations were taught to children, especially to young girls; he observes even that it was by no means rare to find in them children of from ten to twelve years of age able to earn 60 to 75 centimes (6*cl.* to 7½*d.*) a day by their work. In Belgium also public Workshops, or *Ateliers de Charité*, were established, where industrious working people temporarily out of employment were received; while for several years it had been there part of the public policy to seek to reform crime and vice by compulsory labour.

During these years then, Belgium eagerly, and from the earliest moment, seized on the opportunity to recover its ancient pre-eminence in industry and commerce, and its success was continually acknowledged in France itself. In the *Moniteur*, for example, (1807,) it was truly remarked, that it was in uniting agriculture to manufactures and commerce that Belgium was become opulent; "then it was that all eyes were turned upon her, and that she acquired public consideration and respect far greater than that which any other country of Europe had ever enjoyed." To the details of many of the institutions and educational arrangements then established or already at work in Belgium, we shall from time to time return. It is precisely such a country and such a moment of its history that is ever most pregnant with instructive examples for our own. The success of Belgium under the Republic, the Consulate, and the early years of the Empire, was partly, indeed, due to the circumstances of the time, but it could not have happened had not her people, though their industry had been so grievously oppressed for two centuries, still remained always true to themselves, and

preserved, unbroken, their innate national spirit. The nation might have easily counted on completely recovering her ancient rank in Europe, had the ambition of the Emperor been able to contain itself within reasonable bounds—had Napoleon exercised the same command of himself which characterized the phlegmatic northern nature of Charles V.

Amongst the earlier founded institutions of Belgium, the most important received new development and extension in the earlier years of the present century. By decree of 3 Nivose, year XI., Chambers of Commerce were re-organized, entrusted with the consideration of the means of increasing the prosperity of the country, and the exposition of the causes by which its progress was retarded, as well as with the observation of the execution of all public works. These chambers were first established at Brussels and Antwerp only, but afterwards at Bruges, Ostende, and Ghent. By decree of 12 Germinal, year XII., Chambers of Consultation upon subjects connected with manufactures, fabrics, arts, and trades, were established at Louvain, Tirlemont, Nivelles, Saint-Nicolas, Mons, Tournay, Courtrai, Ypres, Maestricht, Venloo, Hasselt, Vaels, Malines, Turnhout, Huy, Liège, Verviers, and Namur. Immediately after the peace of Amiens, the Minister Chaptal applied to the Chamber of Commerce of Antwerp, to ascertain its opinion upon the formation of great public mercantile companies, upon the state of public relations with America and with the North, upon the situation of the mercantile marine, upon the customs tariffs in France and abroad, and upon the keeping up of the harbours. The answers he received were distinguished by the solidity of the practical views which they unfolded.

The laws regulating the powers and procedure of the tribunals of commerce were then also revised and codified; and more clear and systematic rules were framed to govern the spirit of partnership associations. M. Briavoine is, however, mistaken in supposing that the principle was then, for the first time, recognized of anonymous partnerships with limited liability; we have shown on a former occasion that the Irish Parliament may claim the credit of having first affirmed it, long before the governments of France and Belgium.* Councils of skilled men (*conseils de prud' hommes*) were, at the same time, established in the principal manufacturing cities, by means of which the solution of innumerable legal questions arising between masters and workmen was rendered at once more economical and more expeditious, and disputes were easily reconciled.

The political system of the Empire never submitted itself to that doctrine of modern economists which repudiates any interference whatever on the part of the government in industrial operations. The example of Napoleon, indeed, may well be regarded as a great authority against the soundness of that doctrine, for Napoleon interfered most actively and usefully in encouraging and directing for its extension and advantage the industry of the countries placed under his sway. His system of protection (in which he only imitated the successful practice of the English) was carried out by the

* See *Journal of Social Progress*, Vol. I., pp. 12 and 33, (Nos. 1 & 3, Jan. and March, 1854,) and the whole of the articles on "Partnership *en commandite*."

imposition of high customs duties, and the adoption of the most vigorous means, supplied by a criminal code administered by special tribunals, for the effectual punishment of smuggling. This "Continental system," as it was called, was brought to perfection during the early years of the Empire, and though in the end its severity was necessarily relaxed, because in fact it was pushed too far, and used as a mere engine of war—pushed even so far as a wholesale prohibition, the most absolute recorded in history—still during the few years of its duration, Belgium at least gained enormously, and found this a period of unprecedented prosperity. New methods of manufactures were learned with extraordinary rapidity. No bounds seemed to limit the demand of France, and indeed of almost all Europe, for the productions of the Belgian manufacture. Individual houses (as Lefebvre of Tournay) found means to keep three thousand workmen organized, in constant and regular employment. The cloths of Verviers, the printed cotton stuffs of Ghent, the tapestry, porcelain, and hat manufactures of Tournay, the tanneries of Stavelat, Bruges, and Namur, the revived iron works of Charleville, Liège, and Charleroi, (actively employed in the construction of arms for the public arsenals,) all found custom without limit; and many immense fortunes were rapidly realized. The capital city of Brussels was the only exception among those of the interior, but Brussels had lost the presence of the government, and the advantage of being the centre of the administrative system of the whole country. Its lace and its carriages (these the most celebrated in Europe) preserved to it still some industrial life, but the French Empire left it poorer in population in 1814, than it was under the Austrian administration.

One great branch of the national industry of Belgium formed also an exception to the general prosperity at this period: the merchant marine. The political events of the time were opposed to its success, and in fact it did not recover itself. The whale and sea fisheries became more and more impossible. Antwerp, Bruges, Ostende, Nieuport, lived hardly more than in name, or else sought in other resources the means of existence. Bruges turned its attention to the manufacture of linens, laces, and woollen stuffs, which succeeded tolerably well. Ostende and Nieuport could only snatch some passing opportunity, or turn their vessels and seamen to the service of the state. The war with England had almost ruined them.

The fate of Antwerp, once the great commercial capital not merely of Belgium but even of all Western Europe, is of peculiar interest, and must be especially so to one writing in the city of Dublin in the middle of the nineteenth century. For two centuries the Scheldt had continued closed, and those two centuries had caused great changes in the habits of the city. There on the very spot where once the most important business of the world was negotiated, where sovereigns found rivals in munificence and wealth,—there where boldness was once regarded as one of the first conditions of success in maritime enterprise,—a diminished population at last formed itself to an existence of strict economy, a life of manual employment, a commerce of detail; and although in these limited careers, pretty large fortunes were by little and little remade again, still they had been too painfully

amassed to allow those in whose hands they fell to consent to hazard them lightly in the risks of distant expeditions. The opening of the Scheldt (17th December, 1792) had been magnificently celebrated by banquets and illuminations in a city drunk with joy, but men did not hasten to take advantage of that opening. Some houses of Dunkerque, of Germany, and elsewhere from abroad, came and established themselves in Antwerp, and it was one of these that undertook to build the first vessel designed for sea navigation.

Antwerp was then without a marine, and without a dock, and even its quays afforded no convenience for the discharge of cargoes. In 1803, Napoleon visited it as First Consul, and saw at a glance the natural advantages of the great city, its splendid natural harbour supplied to an unlimited extent by the broad, deep, and slow flowing Scheldt, its connexion by the Meuse and Rhine with all the centre of Western Europe. He at once formed the design of constructing a proper port and complete docks, fitted for even a great navy, and he pressed on the work with vigour, regardless of all remonstrances on the part of his financial advisers. The two great basins, one large enough for 12, the other for 40 ships of the line, were completely finished in 1811. In 1805, two corvettes and a frigate were already launched there; in 1810, there were 10 ships of the line in progress of construction; in 1813, nearly 30 ships of war had been launched, and 14 ships of the line were still on the stocks at Antwerp. All these works contributed to accumulate pretty considerable capital in the city, and by little and little the taste for enterprise returned: for the naval engineers and ship-builders of France were generally able men, under whose teaching the inhabitants of Antwerp rapidly formed themselves in the long neglected knowledge of all the arts necessary to the success of maritime navigation.

The commercial operations of Antwerp at the same time became for a while more extensive and important than they seemed at first to promise. In 1803, the city possessed not a single ship; in 1806, 627 vessels of various sizes, either newly built or else furnished by the cities of the interior,* found employment in her port. In the year XII., 2,006 ships (tonnage 94,534) entered the port of Antwerp; in XIII., 2,718 (tonnage 152,393). The customs revenue received by France from the Department of the two Nèthes, in which Antwerp was included, presented a total of 6,000,000 francs (£240,000) in the year XI., and in the following year, 8,237,000 francs (£329,480). The customs duties of all France during the same years only amounted to 50,147,395 fr., and 55,412,242 fr. (£2,005,895 16s., and £2,216,489 13s. 6d.). These figures will give a tolerably exact idea of the commercial position of Antwerp, in the then foreign trade of France. A few years later and Napoleon had pressed the system of exclusion so far, that he himself was obliged to seek some correction for the mischiefs which it brought on the

* The 627 vessels included a tonnage of 25,931: of these Antwerp possessed 115, carrying 4,146 tons; Brussels, 52, of 3,821; Ghent, 24, of 1,629; Rupelmonde, 33, of 809; Boom, 44, of 1,760 tons, altogether.

maritime trade of his ports, in the issuing of frequent special licenses to trade (but at great risk) in foreign commodities. In the mean time the sudden rise of the port of Antwerp was checked almost as much as it had previously been excited.

Antwerp, however, did not cease to be a manufacturing city, at least of the second class. In 1806, she possessed 26 factories for sugar refining, 8 for cotton printing, 4 for spinning, 12 of silk stuffs, 2 of silk ribbons, 1 of silk stockings, 6 of stuffs of silk and goats' hair, 5 dyeing establishments, 8 factories of sayettes mixed with spun worsted, 29 of fustian, dimity, and Siamese cottons, 11 of laces, 34 of spun ribbons, 9 of cloths, and 10 hat manufactories, besides tanneries, breweries, and gin distilleries. The city therefore at this time could number a population of about 70,000 souls, chiefly attracted by these different employments; a population, however, far inferior to that of two centuries and a-half before, at the period of the breaking out of the religious troubles. Antwerp in 1560, contained 218 streets, and 13,500 houses; at the most prosperous moment of the imperial regime, there were but 162 streets, and 10,088 houses, within its walls.

The French Empire fell in 1814, but Belgium tasted scarcely a moment of respite. Diplomacy, without condescending to consult the nation, almost immediately handed it over to Holland; diplomacy considering, as ever, not the justice of the case, not the rights of the people which it was able to deal with by the arbitrary law of the stronger, but simply how the interests of more powerful neighbouring countries might be affected, and how the map of Europe would look after the new arrangement. The union of a naval and commercial power, possessing colonies both rich and extensive, with a great agricultural and manufacturing nation, was evidently advantageous to both in the eyes of the political economists, never dreaming of what might be the feelings (or prejudices, as they are called) of the people themselves: these circumstances of difference themselves speedily proved to be elements of discord, and when combined with difference of religion and of race—including that of tastes and talents—nourished a normal state of rivalry and defiance, which could not fail to terminate sooner or later in war and revolution. Moreover, the whole previous history of the two nations prepared the way for inevitable dissension. The Dutch feared the new freedom of Belgium, especially after the colonies were opened to it, remembering their ancient supremacy in manufactures and commerce; the Belgians on the other hand remembered that to Holland they owed the destruction of their trade, and felt that if they had continued on equal terms the separate commercial prosperity of Holland would never have sprung into existence.

Immediately after the fall of France in 1814, the customs duties of the French government in Belgium were replaced by moderate duties nearly like those of 1706, at once opening the trade of Belgium to the competition of England, without any preparation, and under circumstances by no means equal. The Prince of Orange in taking possession of the Belgian provinces endeavoured to satisfy the complaints of the country by proclaiming his intention "to encourage agriculture, commerce, and every species of in-

dustry." Unfortunately, such promises were never or but tardily fulfilled, for almost every office of the government was filled with Dutchmen, and the spirit of the administration of Belgium was essentially Dutch, and not Belgian, throughout all its details of management. Thus the crisis which necessarily followed the break up of the "continental system" in 1814, continued to depress the industrial energies of Belgium for several years, and no energetic measures were taken by the new government till so late as 1822 and 1823, to restore confidence in the affairs of commerce and manufacture.

After 1823, greater attention seems to have been given to the subject of industrial improvement in Belgium as well as in Holland; and France having adopted protective duties as an encouragement to several branches of its manufactures, many of those of Belgium were similarly protected by way of reprisals—such as cloth, chemicals, glass, spirits, hats, slates, porcelain and earthenware manufactures. In 1822, the influence of the king (who seems to have exerted himself with energy and good will) had established a new bank in Brussels—the *Société Générale*—(the first institution of the kind in Belgium authorized to issue notes payable to bearer), which, however, grew but slowly into recognition. Shortly afterwards the *Société de Commerce* was founded also at Brussels (though its chief seat was at the Hague), as a pendant or complement to the former, and intended to assist in particular the manufacturers and the shipowners. The latter establishment succeeded at once, though Belgium, and particularly Antwerp, had bitterly to complain of its principal action being confined to the northern ports, and that its direction was almost wholly Dutch.

About the same time that these two great societies were established, several other public institutions of great value were commenced. A conservatory of arts and trades was opened at Brussels; free public courses of lectures were founded there, in the sciences useful to industry; special chairs of mineralogy and geology were created in the three universities of Belgium, the Athenæum of Namur, and the Medical School of Brussels; collections of rocks and minerals were ordered in the last named cities. A geological map of Belgium was planned, in order to facilitate the working of its mines; and its execution was confided to able men of science. Courses on Mathematics and Navigation were opened at Ostende and Antwerp, and young men intended to become pilots were taught at the expense of the state. Savings banks were established and encouraged throughout all the provinces. Lastly, in the execution of all public works, only native products and manufactures were employed; for the use of any foreign materials a special authorization was made necessary, which could only be obtained in case of absolute necessity. The greatest public works themselves (such as the canals of Antoine, of Charleroi, of Terneuzen, and of the Sambre, the mines of Luxembourg and Limbourg, &c.) were undertaken by commercial companies, to which the Dutch government, ever desirous to excite the principle of association, gave a constant and powerful impulse. During the fifteen years of the Dutch sovereignty, too, there were three public Industrial Exhibitions; at Ghent, in 1820; at Haarlem, in 1825; and at Brussels, in 1830. In all prizes were distributed to the

best manufacturers, and in every such contest the southern provinces exhibited the most incontestible superiority.

Yet notwithstanding the government of Holland was by no means of the worst, still the partiality of the Dutch administration was so constantly shown for Dutch employes even in Belgium,—and Belgian interests, however well attended to when their advantage tended directly to that of Holland, were so uniformly sacrificed whenever they seemed to clash in the least with those of their political masters,—that it was morally impossible for the growing Belgium nation long to continue its connexion with its neighbour on such terms as those which foreign force had imposed upon it in 1814-15. The universal pecuniary support given by all the Belgian cities, indeed by all the people, to M. Vanderstoreten, who was fined 3,000 florins (in the first prosecution of the press undertaken by the Dutch government) for complaining of Dutch partiality, and the ruin it seemed likely to create, abundantly proves the unanimity and vehemence of the popular feeling upon the subject. The Dutch government, besides, in paying a laudable attention to the general education of the country, was unable there any more than in other departments of administration, to hold the reins with moderation and partiality; and the religious differences between the two nations early added a sharp element to those of international discord, already so numerous. The result of all these things was easy and inevitable; it was Revolution; a Revolution successfully concluded in the peace and happiness of complete national Independence.

The misfortunes of Belgium in past ages always arose from the want of national unity among the people. The different provinces had always each a separate life, and they regarded each other too exclusively as rivals in trade to feel otherwise than jealous and hostile to each other's improvement in wealth and prosperity. In France and in England, the spirit of feudal institutions gave way before an ever increasing Central power, which concentrated the sentiments as well as the energies and the material force of the whole nation: in Belgium they were supplanted by the Communal spirit alone; and for centuries the provinces forgot that to make the spirit of localization of rights really wholesome in its action, all the little local centres must not only be strongly connected together in a harmonious whole, but the strength of the whole must be expressed towards other nations by a supreme centre of government, impressed in its every act with a vigorous national spirit. Industry seemed to Belgium to be the mission of the country, and to the too great neglect of their national politics may be traced the cause of almost every disaster which even in their commerce and manufactures the nation for centuries suffered. If it had secured its political independence (which with less of provincial disunion it might have easily done), Belgium had known no treaty of 1648, none of 1715; it had not known that commercial decline of a century and a-half, and from the influence of which it has not even yet ceased to suffer.

"There is no people," says M. Briavoinne, "it is true, whose conscience is more spotless or more morally free, than that of the Belgians. They

have never committed a political crime, they have never plotted perfidy to triumph over their neighbours. Rarely have the Belgians carried war beyond their own frontiers, urged by the desire of pillage or of conquest; but they have lived longer than any other nation amidst constant civil disorders. Rich and prosperous at an early period of semi-civilization, they have been the executioners of their own political life; they have themselves destroyed the work of their own progress. Instead of keeping out from their community the billows of popular passions, they have retained and fostered them among themselves, till they were submerged beneath their violence. With a destiny open to them the fairest among all the nations round, they have had to sustain the rudest shocks of adversity, through their own fault alone, and in consequence of a vicious political education. Let us not seek elsewhere the origin of their reverses, and of the commercial oppression to which this nation was reduced, able as it was in the acquisition of wealth, but ignorant of how to defend itself against the jealousy and rapacity of foreign rivals." The picture has also, however, another side; for, notwithstanding all its political mistakes, and the consequent difficulties under which its commerce had to make its way to our own times, the national genius for industrial exertion never flagged, and the people seemed as fresh on the occurrence of each new opportunity for its exercise as if they had never suffered any discouragement. This elasticity was in part owing to the personal independence of the great bulk of a population, where the lands were from time immemorial divided equally amongst the children of their cultivators, where no law of primogeniture sacrificed the well being of the masses to the exaltation of an undeserving aristocracy. But the chief cause lies in the quiet character and moral habits, and social traditions of the people. The whole may thus be summed up in the words of the same writer, with which we may also aptly conclude:

"We have seen the Belgians," says he, "preserve their traditions of labour as well as their regularity of morals. They show themselves more and more sedentary and quiet; without doubt, they remain industrious because they are moral; and, let us add, that they continue moral because they are industrious. But where is the principle which keeps them within this happy circle? We can discover it in a hereditary custom, which, from the earliest times, has made of each of them at once a farmer and an artisan. This combined labour constrains a man to constant occupation, and one which imposes upon him an almost continual isolation from crowds, and respects the strict division and distribution of families, a powerful safeguard against all the elements of disorganization. Thus, a purely material cause, the manufacture of woollens and linen spread over the little villages more than in any other country, has had a conservative influence over the moral destinies of the people. It is also to this fact that we may attribute the unchangeable character of this nation, and the little traces left on it by foreign domination, or the political connection which it has suffered from time to time with its neighbours."

"Venice, once dead, has not come again to life: Genoa, Malta, the Italian Republics, Spain, Portugal, Holland itself, each in its day elevated

to the first rank, have witnessed their gradual decline without any hope of arresting it. Belgium takes another course: three times, within sixty years back even, it has been ruined; very much oftener within the previous two centuries; but always its wounds heal up, and it takes the road again, a continual subject of astonishment and envy to surrounding nations."

NOTICES OF BOOKS.

Office Hydraulic Tables, for the use of Engineers engaged in Water Works, giving the discharges and dimensions of River Channels and Pipes.
By JOHN NEVILLE, C.E., M.R.I.A., County Surveyor of Louth.
London: John Weale.

IN the practice of engineering it is most desirable to economise time and mental labour, especially in connexion with calculations. Those who are best acquainted with rules and formulæ cannot always afford time to employ them in detail, and may thus, perhaps, be occasionally tempted to use them in a rough or approximate manner. The formation of tables has been thus found indispensable for a multitude of practical questions, among which those bearing on water works occupy a prominent position.

The object of the collection of tables now arranged by Mr. Neville is evidently to permit engineers who are engaged in works relating to the management of water, to easily and quickly find such results as they may require in the course of practice. The tables are all contained on one side of a single sheet, so as to admit of being framed, or otherwise conveniently exhibited in an office, so that any required numbers might be obtained at a glance. They are three in number:—Table I. gives the mean relative dimensions of equally discharging trapezoidal river channels, with slopes varying from $2\frac{1}{2}$ to 1, to a vertical direction. Table II. gives the discharge in cubic feet per minute from the primary channel 100 in width, and the corresponding mean depth taken as feet. This table seems to be especially applicable in drainage works, or in those undertaken to preserve lands from the effects of inundations, as it will give for each particular case the dimensions of channel which will answer best, in conformity with the requirements of the case, for keeping the water surface below the level of the neighbouring lands. Table III. is adapted for use in connexion with water works, as it is capable of giving the velocity in inches per second, and the discharge in cubic feet per minute, from a cylindrical pipe, when the diameter and fall are given. Portions of these tables have been already given in Mr. Neville's volume on Hydraulic Formulæ, &c., and they seem to be all calculated according to the rules contained in that book.

Recent researches having shewn that the hydraulic mean depth, or mean radius, and consequently the diameter of a tube, influences the resistance to the flow of water to a greater extent than what has been pre-

viously supposed, it is probable that these tables would be slightly changed by taking the matter into account. From a notice which appeared in this *Journal* of the experimental researches of M. Darcy,* it appears that one of the terms in the formula, expressing the resistance, varies inversely as the mean radius of the tube, consequently, comparing this experiment with that usually given by writers on hydraulics, it follows, that in table III. of those now under consideration, the velocities for tubes of great diameter would be too low, and for those of small diameter the velocities would be too high. This we have already found in two or three instances, but the differences are not considerable, and we shall defer further details on the point until M. Darcy shall have published his tables.

However useful tables of reference may be in practice, they do not dispense with the study of the principles on which they are based; this is especially the case in hydraulic engineering, where the circumstances under which an engineer may have to act are capable of infinite variety. The geographical and physical circumstances of Ireland have repeatedly been referred to as showing its adaptation for all kinds of operations connected with water. Its streams and rivers present sources of power equivalent to the annual combustion of millions of tons of coal; its surface presents facilities for important lines of inland navigation;† immense areas of its fertile soil are rendered useless by their moist and saturated condition. The multitude of complex practical problems in mill-work, works of navigation, and drainage, which such facts suggest for solution, can never be safely undertaken without the possession of sound knowledge on the subject of hydraulics. Of the existence of such knowledge in Ireland, we regret to perceive but little evidence in any of the great public works hitherto accomplished; and what is yet more extraordinary, very little attention seems to be given to the study of hydraulic engineering in any of the public seminaries of education, which profess to embrace in their curriculum the teaching of industrial science. Thus, although we find in the report of the Dublin University Commission, Appendix A. p. 199, some mention made of the study of hydrostatics and hydraulics, it seems to be only of a very elementary and general nature. The calendars of the Queen's Colleges show that the study of hydraulics in connexion with their engineering schools, has been almost entirely omitted in the courses taught in these establishments. Schools of practical science in Ireland should aspire to do something more than to provide assistants to railway engineers, or a staff of surveyors for public relief works. We would request those who are entrusted with their management to look to Belgium, where industrial knowledge has acquired the greatest development, and been crowned with the most satisfactory results. Let them examine the admirable manner in which engineering and industrial science are taught at the schools of Ghent and Liège, and we feel assured that our remarks on the system pursued in Ireland will be acknowledged to be far from severe or exaggerated.

* *Journal of Industrial Progress*, Vol. I., p. 221.

† See *Journal of Industrial Progress*, September and October, 1854.

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ART. I.—*On the Apprenticeship Workshops and Apprenticeship Schools of Belgium.* (Ateliers d'Apprentissage and Ecoles d'Apprentissage.)

INDUSTRIAL INSTITUTIONS OF BELGIUM.—No. I.

THE historical sketch of Belgian Industry given in the February number of this journal, relieves us from the necessity of making any preliminary observations in the present paper upon the previous condition of that country, at the same time that it will enable our readers to form a juster notion of its present condition, and of the measures which have been taken to revive its industry. As that sketch brings the industrial history of Belgium only down to the period of the Revolution, by which it emancipated itself from Holland, it is necessary to make some observations upon the effects of that change upon its manufactures and commerce.

The few years which succeeded the peace of 1815 were very disastrous to Belgian manufactures, owing, on the one hand, to the great French market having been closed up by the separation from France, and to the competition of English manufactures, which had only to encounter very light duties, rendered so to favour Dutch commerce. The first real step taken to revive manufactures was, the grant in 1817, of the old archiepiscopal palace of Seraing, to the brothers, Charles, James and John Cockerill, on the condition that they would establish an iron works and machine factory, according to the English fashion, upon a gigantic scale, which might serve at once as a model and as a source from which machinery might be obtained, without being obliged to have recourse to foreign nations. Seraing, situated two leagues from Liege, on the banks of the Meuse, in the midst of abundance of iron and coal, was admirably adapted for the purpose. As great difficulties stood in the way of the execution of this project, a flax spinning factory was first organized in the building. In 1819, the original idea of creating an iron works was revived under the immediate encouragement of the King of Holland, who personally visited the factory during the first trials, which consisted in the construction of flax spinning machinery and steam-engines. But it was only between the

years 1822 and 1823, that the foundation of the present gigantic works, perhaps the most complete in the world, was laid.

The first effect of the establishment of Seraing was, to produce a number of good mechanics, and to bring the use of steam power and labour saving machines into general use. It also paved the way to the creation of large fortunes, and the working of coal mines, and the manufacture of iron on a large scale. And here we may remark, that, John Cockerill was also one of the first who introduced into Belgium the English method of making iron by means of coal.

The sudden impulse thus communicated to Belgian manufactures demanded a new organization of the public credit; and accordingly steps were taken to found a great bank, under the name of the *Société Générale pour favoriser l'industrie nationale*, with a capital of 50 million of guilders, (about £4,166,000,) in 60,000 shares of 500 guilders (£40) each, but with power to commence operations so soon as one-half of the capital should be subscribed for. Part of the capital, to the extent of 20 millions, was to be invested in land, which the King sold on favourable terms, the Society paying the purchase money by gradual instalments.

This Joint Stock Bank, having its head quarters at Brussels, was in a position to establish branch banks throughout the country, for the discounting of bills, in which its operations would be very much facilitated by its privilege of issuing notes, payable to bearer, to the full extent of its capital; and in addition, it was made the medium for receiving and paying the state funds. Besides its discount business, it was also a bank of deposit; but its most important feature was, that it could make loans on public securities, on goods, and even upon manufacturing plant.

Notwithstanding the advantages which such an institution, then so much wanted, held forth, and the fact that the King guaranteed 5 per cent. upon the capital, it did not meet with much support when first originated. Only 6,500 shares out of the first issue of 30,000, were subscribed for. The King of Holland was accordingly obliged to take up the remaining 23,500 shares, in order to prevent the whole project from falling to the ground. In the course of a year, however, the shares rose above par, chiefly owing to the ordinance of the 30th of August, 1823, which raised the import duties upon several articles, by way of reprisal upon the hostile tariff of other countries. Capital now flowed in abundance to the bank, which being in turn thereby enabled to discount freely, and to make advances upon goods and upon plant, gave an immense impulse to manufacturing industry, whilst the general commerce of the country was improved by the increase of its circulating medium from the issue of the notes. The extent of this impulse may be judged from this, that in 1827 the bank discounted to the extent of half its capital; and in 1830 the amount of its discounts exceeded its capital.

The success of the *Société Générale*, after the first year of its existence, called another joint-stock bank into existence, under the name of the *Société de Commerce*, and whose chief seat was at the Hague. As its name imports, it was destined for the encouragement of commerce, and especially of the Dutch export commerce in Belgian manufactures, by discounts

and loans in connection with exports. King William also patronized this bank, not in name, but in reality; for besides taking shares to the amount of four millions of guilders (about £320,000), and pledging himself to the extent of twelve millions (about £960,000)—the whole capital being thirty-seven millions (about £2,960,000)—he further guaranteed the shareholders four and a-half per cent. In a few days the subscriptions amounted to seventy millions of guilders (about £5,600,000.)

Through the active support of the credit system thus organized, new manufactures sprung into existence; new machine factories were established, especially in the district of Charleroi; the iron and other metal trades extended at Liege; the use of coal as a fuel for the manufacture of iron rapidly increased, as did similarly the cloth manufacture of Verviers, and the cotton-spinning at Ghent.

The spirit of association also grew up, chiefly in consequence of the example afforded by the banks, and their active assistance in all projects. Companies were formed for working mines, the construction or completion of canals, and for insurance and assurance of property and life. In 1830 the total capital of all the joint-stock companies got up in connection with the two banks, amounted to £10,000,000.

The revolution of 1830, in giving freedom to Belgium, at the same time diminished its trade; for, by its separation from Holland, it lost the important market of Java, and the benefits derivable from the extended commerce and wealth of Holland.

Under the impulse of a national government, and especially under the direction of the enlightened minister, M. Rogier, it was resolved to counterbalance this loss, by stimulating internal commerce, by improving the means of communication, and of giving a new impulse to foreign commerce, in making Belgium the highway of German commerce, by connecting the Rhine with the sea by a railway. Not only was this done, but the whole country has been covered with a network of railways; new canals have been cut, others completed, and the navigation of the rivers improved.

The great benefits conferred upon Belgian industry by the financial enterprise of the King of Holland, were very naturally lost sight of in the struggle for independence. The General Society was especially taxed with being imbued with the single object of accumulating wealth, and with being anti-national, in consequence of the large share which the King of Holland had in its property. Another cause of unpopularity arose from its relations with the public funds before the Revolution. As already remarked, it had been made the depository of the taxes raised under the Dutch government. When the Revolution broke out, therefore, they held large sums of this kind, which the Dutch government would have claimed, had it succeeded in conquering Belgium, but which the national Belgian government naturally claimed as their property. The bank delayed meeting the claim of the latter as long as possible; and hence, although it could not be denied that the general society had rendered eminent services to the country, it was considered indispensable to its perfect independence that another and similar institution should originate with the national party. This institution was the Bank of Belgium, which, in its chief fea-

tures, resembled the General Society. Its capital was, however, much smaller, and the state did not guarantee any interest, but, on the contrary, stipulated that at least one per cent. interest should be given upon all public funds with which it may be entrusted.

By the establishment of the Bank of Belgium, a good deal of French capital was imported into Belgium, and a rivalry at once sprung up between the two banks, which did immense service to the country. Numerous industrial undertakings were set on foot; and many proprietors of mines, iron works, and factories, who had not the capital to work them effectively, formed companies under the auspices of one or other of the banks, and in this way made large fortunes.

Two new societies or banks were also formed as offshoots of the General Society, called the Society of Commerce, and the National Society, and having the same objects as the parent body and the Bank of Belgium. Under the patronage of the General Society and of its two offshoots, thirty-one companies were formed between 1830 and 1838, whose total capital amounted to 102,640,000 francs (£4,105,680.) These companies included projects of all kinds, such as canals, railways, steamboats, beet-sugar factories, sugar-refineries, carpet and mirror factories, iron works, &c.

Under the direct patronage of the Belgian Bank, twenty-two companies were formed, chiefly for the working of mines, and for the extension or establishment of various manufactures, among which may be mentioned the celebrated company of the Vieille Montagne zinc works, the iron works of Ougrée, and the glass works of Charleroi. The total capital of these companies amounted to 54,150,000 francs (£2,166,400.)

The united capital of the General Society and its two offshoots, amounted to 125,000,000 of francs (£5,000,000.) To this must be added a reserve of more than 22,000,000 of francs (£880,000), existing in 1838, and also the sum of 12,000,000 of francs (£480,000), representing the capital of one of the companies formed—an insurance company, whose capital was not sunk in plant, and could be therefore employed to meet a crisis. That is, a total capital of 159,000,000 of francs (£6,360,000), to meet liabilities to the extent of, at the utmost, 100,000,000 of francs (£4,000,000.)

The Bank of Belgium was not in an equally favourable position, for its whole available capital, inclusive of 12,000,000 of francs (£480,000), representing that of a company included in the twenty-two companies above-mentioned, whose capital could be at once made available, was only 32,000,000 of francs (£1,280,000), against which there were liabilities to the extent of 42,150,000 of francs (£1,686,000); that is, 54,150,000, less the 12,000,000 of realizable capital. And accordingly, when a crisis occurred in 1838, the Bank of Belgium suspended payment, and the greatest commercial disasters would have occurred, if the General Society had not succeeded in weathering the storm.

The spirit of association thus developed, and which was not confined to the formation of joint-stock companies alone—for a great number of private companies, on the principle of limited liability, were also formed—raised the mining operations, the manufacture of iron and other metals, and many

branches of Belgian industry, to a level with the most improved of other nations.

The effects of the application of steam power to manufactures, the invention of labour-saving machines, and the improvement of processes by the application of science, which commenced with the end of the last century, were now beginning to exert a decided influence upon the industry of Europe. It soon became evident that not only would the first rank in industry belong to that nation which would most fully take advantage of the revolution effected in industry, but that it was absolutely necessary to do so at once, in order to prevent the manufacturing industry of a country from being gradually destroyed by the competition of the more advanced nations.

Were it not for the credit system thus organized, whatever its intrinsic defects may have been—and they were numerous—Belgium would not have been able to maintain its position as a manufacturing country. The extent to which it has taken advantage of the revolution in industry, may be best judged by the progress which it has made in several great branches of trade; as, for example, the working of its coal, iron, and zinc mines, its glass and iron, and even its woollen and cotton manufactures, which have greatly increased in importance, notwithstanding the check which they received in 1834, by the entrance of the greater number of the German states into the Zollverein, or German Customs Association, by which its best market was cut off.

Thus, for example, the average number of persons employed in coal-mining from 1840 to 1845, was 38,992, and in the next five years, 45,839. The total average quantity of coal annually raised, from 1831 to 1835, was only 1,575,000 tons, while in 1851 it was 6,234,000 tons.

In 1841, 2,286 persons were employed in metallic mining; in 1850 there were 5,700; at the same periods, the number of steam-engines employed increased from 8 to 36, or from 107 to 1,208 horse power. The quantity of zinc ore raised, increased from 19,000 tons to 62,000 tons, and the iron ores from 179,000 to 473,000 tons. The manufacture of zinc from the ores of the *Vieille Montagne* district increased enormously since 1840. In 1851, 2,640 persons were employed in raising the ore, and extracting the zinc, and rolling it into sheets. The total quantity produced was 11,593 tons, or about one-fourth of all the zinc produced in Europe, and four-fifths of all made in Belgium.

The imports of raw cotton for home consumption, rose from 16,548,752 lbs. in 1841, to 26,712,060 lbs. in 1852. The export of cotton fabrics in 1841 was 1,159,187 lbs., and in 1852 it had risen to 3,695,127 lbs.

The woollen industry of Belgium has greatly increased. The export of cloths and other fine fabrics of pure wool, amounted to 1,398,989 lbs. in 1841, and to 1,842,444 lbs. in 1851. The number of spindles engaged in spinning woollen yarns has also greatly increased, but large quantities of yarns are still imported. The production of woollen fabrics other than cloths, is also still far below the annual consumption of the country.

The various manufactures dependent upon the cheap production of iron and upon abundance of fuel, have naturally followed the general progress.

For example, the export of nails in 1841 was 4,526 tons, but in 1851 it had risen to 9,061 tons, or fully double. The total export of fire arms in 1841 was 2,418,277 francs (£96,731), and in 1850, 4,923,900 francs (£196,956), or more than double. Similarly, the value of the exports of machinery in 1850, exceeded that of 1841 by 1,315,000 francs (£52,600.)

In 1840 the Belgian glass-houses produced 20,000,000 square feet of glass; in 1847 the produce had risen to 32,000,000 square feet. The export of all kinds of glass in 1841, was 106,496 cwts., and in 1852 it had reached 348,214 cwts., exclusive of plate glass, to the value of £49,490, the manufacture of which commenced only in 1840.

In 1841, Belgium imported paper to the value of 378,000 francs (£15,120), and exported to the value of 220,000 francs (£8,800.) In 1850 the export rose to 1,500,000 francs (£60,000), while the import fell to 240,000 francs (£9,600.)

The influence of the Belgian credit system, and of the development of internal communication, as well as of the active interest exhibited by the Belgian legislature and government, upon the progressive development of the manufactures and commerce of the country, may be thus summarized. If we classify the commerce of the country for the year 1851 into, 1st, raw materials; 2nd, food; 3rd, manufactured articles; and represent the whole importation and exportation each by 100, the following will be the per-centage of each of the three classes of articles:—

	Importations.	Exportations.
Raw materials .	43 per cent.	43 per cent.
Articles of food .	40 "	15 "
Manufactured articles	17 "	42 "
	<hr/> 100	<hr/> 100*

The export of the products of labour is, therefore, nearly two and a-half times more in proportion than the imports of the same kind of products.

A comparison of the commerce of the five years from 1840 to 1845, with the corresponding period from 1845 to 1850, gives the following interesting results:—

The import of raw materials increased to the extent of	7 $\frac{1}{10}$ per cent.
The import of food to	15 $\frac{1}{10}$ "
Whilst the import of manufactured articles had, on the other hand, fallen to the extent of	17 $\frac{1}{10}$ "
The export of raw materials increased to the extent of	41 $\frac{1}{10}$ "
" " food	53 $\frac{1}{10}$ "
" " manufactured articles	13 $\frac{1}{10}$ "

This increase in the export of manufactured articles is the more remarkable, as the second period of five years includes the years 1848 and 1849, which were highly unfavourable to commerce.

The spirit of association which was developed to so extraordinary an extent in the first ten years of Belgian freedom, appears to keep pace fully with the progress of its manufacturing industry. In the five years between 1845 and 1850, no less than 511 new partnerships of the

* *Journal of Industrial Progress*, vol. i., p. 59: Statistics of Belgian Commerce.

ordinary kind, and 110 companies on the system of limited liability, were formed and registered before the tribunals of commerce. In 1852, the number of joint-stock companies had increased to 191, with a nominal capital of 880,347,298 francs (£35,213,891). This capital was thus distributed:—252,000,000 of francs (£10,080,000) were engaged in banks and similar institutions; 40,000,000 of francs (£1,600,000) in commercial undertakings; 185,000,000 of francs (£7,400,000) in mining and the manufacture of metals; 20,000,000 of francs (£800,000) in manufacturing industry, especially in the textile manufactures; 10,000,000 of francs (£400,000) in sugar factories; 10,000,000 of francs (£400,000) in glass factories; and the remainder in various other branches of industry, such as roads and canals, navigation, railroads, insurance companies, &c.

From the foregoing statements it is evident that Belgian industry is in a highly prosperous condition, so far as production serves as an index of its condition. The position which its cloths, its glass, its fire arms, and its machinery hold in foreign markets, is sufficient proof of the degree of perfection which it has attained in several branches, and which was amply attested by the part which it took in the London Exhibition of 1851.

There is one branch of Belgian manufacture, however, which we have not hitherto mentioned, which forms a great exception to the general state of prosperity, namely the linen manufacture, one of the oldest, most celebrated and considerable branches of the trade of Belgium.

The Belgian linen industry, like that of Ireland formerly, to a considerable extent was a domestic manufacture, which only occupied the leisure hours of the family, or in winter, when out door agricultural labour was impracticable. The farmer or labourer who tilled a little land, planted a patch of flax, which he steeped, scutched, and hackled, and which his wife or daughters spun and bleached; the yarns thus made, were either woven into fabrics by the owner of the flax himself, or sold to others; in either case the produce was sold at the local markets or fairs to the merchants.

This kind of industry created a new class of workers, that is, weavers who were not rich enough to possess land, and consequently did not grow flax, but who possessed a loom and a cottage, and either purchased or obtained on credit from some farmer sufficient yarn to make a piece of linen, which they wove in winter and then sold, whilst in summer they hired themselves as agricultural labourers.

The latter class soon divided itself into two others, one composed of men who had acquired some capital, and who purchased the flax in the straw, and had it steeped, scutched, spun, and woven—small manufacturers in fact; and the other composed of those who did not even possess a loom, and who worked by the piece for the others.

Such was the classification of the people engaged almost exclusively some years ago in the linen manufacture of Ireland; such is to this day, that of those employed in it in Belgium.

An agricultural population being notoriously the slowest to progress or take advantage of improvement, the direct connexion of the linen manu-

facture with the cultivators of the soil was, judged from a merely manufacturing point of view, injurious to its development. The same processes for the preparation of the fibre were followed for centuries, the same rude looms were used in weaving the fabrics.

The linen manufacture in parts of Ireland was to some extent an exception to this rule, for in many respects it assumed the character of a forced or exotic manufacture, because it suited the purposes of the English government to specially encourage the linen manufacture after their infamous suppression of the woollen manufacture. The appointment of a board of trustees for the linen and hempen manufactures by the Act of 1699, but which was only definitively constituted in 1711, stimulated improvements in the processes for preparing the flax, and in the looms used in weaving; it furthermore endeavoured to separate the linen manufacture to some extent from its too close alliance with agriculture. The means which they adopted for this purpose were the importation of Russian and Dutch flax seed; the distribution of the most improved implements; the appointment of competent persons in different localities to superintend the management of the flax crop; the numbering of the yarns; the appointment of inspectors and seal masters to superintend the localities where the manufacture was carried on, and to brand the sowing seed; the giving of bounties for the sowing of flax seed, for the building of scutch mills, for the spinning of fine yarns, the establishment of spinning factories, and the manufacture and exportation of particular kinds of linen fabrics. From 1711 to 1737 the board had £6000 a year at their disposal for these various purposes; and in the latter year it was increased to £20,000 per annum, at which it remained for very many years. Although a large amount of these funds were squandered in jobbing, many of the objects for which the board was established were effected, more especially the communication of a more manufacturing spirit to the whole industry.

The invention of the machinery for spinning cotton naturally led to similar attempts being made to spin flax; and accordingly, so early as 1793, machinery for spinning flax was erected in England, and soon spread, and in 1805 the first mill was erected in Ireland. Although a bounty of thirty shillings per spindle led to the establishment of several factories, whose aggregate number of spindles in 1809 was 6,369, flax spinning by machinery made but little real progress in the linen districts of Ireland previous to 1825; for out of fourteen flax spinning factories existing in 1815, only five were in Ulster.

In the early stages of flax spinning the yarn was dry spun, and was necessarily coarse, and was only employed for canvass, sail cloth, and coarse drills for trowsering. The machines were gradually improved, and yarns of higher numbers made; but the greatest improvement effected was the invention of the process of wet spinning, by which much finer yarns, and of remarkable uniformity, could be produced. In 1825, English and Scotch yarns made by this method were largely imported into Ireland, and completely undersold the hand spun yarns.

Mere cheapness was not however the sole cause of the preference shown from the first for mill spun yarns; they are more uniform in thickness and

consequently an even fabric, and one more uniform in quality can be made with them, than with hand-spun yarns. A linen merchant could now make up an order for any quantity of linen fabrics, and be certain that all the different pieces would have the same degree of fineness and the same appearance, and be exactly the same as the sample. This he could not formerly do with hand-spun yarns; indeed it was an extremely difficult task for a linen merchant, and required considerable skill, to assort his parcels of linen correctly, from the variations in the quality of the yarns employed, even the same piece of linen often exhibited considerable variation in the uniformity of the threads composing it.

It was fortunate for the Irish linen trade that the struggle between hand-spun and mill-spun yarns was not protracted, and that flax mills were rapidly erected in the north of Ireland, for otherwise Irish linens would have been driven from all the markets of the world.

A large proportion of the fabrics made in Ireland did not require very fine yarns for their production, being chiefly medium numbers; the flax produced in Belgium, on the other hand, is of very superior quality, and admits of being spun to very fine numbers, fitted for muslin, lawn, &c. Mill-spun yarns accordingly came into competition first with Irish hand-spun yarns, and did not much effect the finer Belgian ones, which could not as yet be spun by machinery; gradually however this took place, and with the exception of the yarns, from 400 to 800 lea, used for making cambrics and lawn, all those required for the production of the great mass of linen fabrics can be mill-spun.

From the more intimate relation existing between agriculture and the linen trade, the struggle between human labour and machinery was continued longer in Belgium than in Ireland, and, for the reasons just stated, it also commenced later. During the first few years after the establishment of Belgian independence, the linen industry may be said to have maintained its ground, its total production being still valued in 1840 at £2,400,000, whilst in the commencement of the century it did not exceed £1,000,000 sterling. Owing, however, to the competition of cheaper fabrics, made from mill-spun yarn, prices rapidly fell, so that but little profit was made, or in other words, the wages fell enormously. This state of things did not naturally encourage the employment of capital in such a branch of industry, when so many more profitable fields were then open to it. So precarious was the condition of the Belgian linen manufacture in 1834, that the government protected it by an import duty.

This had some effect for the moment, but it is evident enough that such a measure could do little permanent benefit to an exporting country, since it was not at home that the protection was so much required as in the foreign markets.

In the years 1838 and 1839 the condition of the population engaged in the linen manufacture was pitiable in the extreme, in consequence of the continual diminution in the rate of wages, and the stagnation in the exports, owing to the competition of machinery, which was every day becoming more formidable. With the object of mitigating their misery, a society was formed under the name of *Association Nationale pour le*

progrès de l'ancienne industrie linière. It proceeded by way of inquiry: experiments were made to determine the best processes of manufacture, and the usage of those pronounced to be the best recommended; useful notions were diffused by a monthly publication, and by small books, adapted to the comprehension of those to whom they were addressed; agents were sent to foreign countries to study the different markets and the taste of the consumers; prizes were established to recompense those who effected any improvements, and for excellence of manufacture. Another of the ways by which it proposed to effect its object was the establishment of schools, where the practice of the most improved method might be taught, and model workshops for the purpose of varying the products. This remarkable association effected a good deal of good, but the evil to be cured was too great and too wide spread, and demanded more exertions than a single society could bestow. The society accordingly recommended that the government should take the matter up, and institute an inquiry into the condition of those engaged in the linen trade.

The government named a commission in the beginning of 1840, and received a report from it in October, 1841. From this report, and a correct census made in 1843, it appears that the two Flanders had a population of about 1,400,000, of whom not more than 1,000,000 were rural. Of this population 79,054 families, comprising 287,527 individuals of all ages, were engaged in the linen industry! The total number engaged in this branch of industry in the same year, 1843, in the two Flanders, Hainault, and Brabant, was 328,249, who were thus classified:—

Weaving	...	...	...	75,821
Spinning	...	...	...	194,091
Scutching and hackling	...	...	...	76,337

From these figures we can at once understand how easily the population of these provinces could be reduced to starvation by a sudden crisis in the linen trade, and the magnitude of the impending pauperism.

In 1838 the export of linens was still valued at 37,000,000 francs (£1,480,000), but in 1839 it had fallen to 24,000,000 (£960,000). It had not, however, then reached its lowest point, for in 1848 it was only 11,000,000 (£440,000), but rose in 1849 and 1850 to 16,000,000 (£640,000). In addition to the competition of machinery, the Belgian linen industry had now to contend with other difficulties. Its chief market, France, had so greatly developed its own linen trade, that a protecting duty, which, in its beginning, permitted the entrance of the Belgian fabrics, was gradually rendered prohibitive; another market from which much was hoped, Spain, shattered those hopes in 1841, by imposing a duty of 60 per cent. upon linens.

An idea of the diminution in the rate of wages which had taken place, and to which allusion has already been made, may be formed from the report of the commission of 1840. According to that report it would appear that the wages of those engaged in the linen trade varied from $1\frac{1}{3}d.$ to 10 $l.$, but that the majority did not earn more than $5\frac{1}{3}d.$ This misera-

ble rate of wages could not, however, be altogether attributed to the competition of machinery, for, in the opinion of the commission, it arose also in part from the backward condition of the manufacture in a technical point of view. It accordingly recommended the employment of the fly shuttle, which had not yet made its way into the rural seats of the industry; it also recommended the use of the compressing templet, instead of the old one with points, and a better system of assorting the yarns according to a fixed scale; the improvement of the bleaching and finishing establishments; and a careful maintenance of character, by keeping back low quality articles from the great markets; and finally, it suggested the formation of a company for the export of linens.

For the purpose of giving effect to these recommendations, the commissioners proposed the appointment of local employment-committees. This proposal was sanctioned by the permanent provincial councils of Ghent and Bruges; and regular instructions were accordingly drawn up for the guidance of the local committees, which received the royal sanction in August and October, 1843.

Some few were at once constituted and set to work. In the years 1845, 1846, and 1847, the price of provisions had risen so enormously, that thousands were reduced to starvation, which was soon accompanied by its attendant, disease. Great numbers of the local employment-committees were now organized; in East Flanders alone, there were no less than 248, of which 243 were in the villages. Each committee consisted of five or seven members, of which the mayor of the commune was *ex-officio* president, and the parish clergymen *ex-officio* members. The business of these committees was, in the first instance, to determine by what means the distress of the locality could be relieved, by affording employment; to provide a stock of raw materials, according to the means disposable, and to the wants of the locality; the introduction of the system of classifying hand-spun yarns; and to recommend the production of fabrics of genuine quality, and the employment of the best methods and the best tools; and, lastly, where possible, the introduction of new branches of industry.

In order to direct these numerous committees, and to regulate the expenditure of the money granted for assisting the linen industry, and increasing the sources of employment of the working classes, a central industrial council was created at Ghent. The formation of another was subsequently authorized at Bruges, but was never called upon to act, as the governor preferred acting through a qualified and energetic officer, who would execute with dispatch and accuracy whatever may be required.

In the greater number of cases, the local committees employed the destitute in spinning flax, and in weaving linen; some also in making roads, and the females in embroidery and lace working. The object in these cases, was not so much the amount which they might earn, as to give the assistance afforded the name of wages, and thus save as many as possible from the demoralization attendant upon the reception of alms.

The majority of the persons to whom the carrying out of these measures was entrusted, however well-intentioned, were but ill suited for the responsible duties which devolved upon them. So far as distribution of relief,

and the alleviation of the sufferings of the population was concerned, they did good service; but, as usually happens in similar cases, the majority of the members composing them possessed neither the energy or technical skill, or mercantile knowledge necessary to reorganize the industry of the nation. Whenever they attempted to employ the people, the articles produced were, perhaps, those not in demand, and, in most cases, they were of so inferior a quality as to injure the market. The roads, too, which were made, were not always properly constructed, or of much utility, forming, in these respects, a perfect parallel to the far more famous case of the Irish Relief works.

For the purpose of enabling our readers to contrast the measures which were taken in Belgium to mitigate the dreadful destitution of the years of famine, with those adopted in Ireland under the same circumstances, we shall give a few statistics of pauperism, which will show that its amount was little, if at all, inferior to what it was in Ireland. But how different the results!

In 1818, after the prostration of trade by the separation from France, and the general stagnation in all branches of industry which followed the peace of 1815, and before the organization of the public credit by the King of Holland, the proportion of persons receiving relief in East Flanders, was equal to $10\frac{3}{4}$ per cent. of the whole population (69,424); but in 1848 it was 26 per cent. (201,760), or, in other words, every four persons had to support a fifth. Matters were still worse in West Flanders where already, in 1837, owing to the decline of the linen trade, 113,343, or 18 per cent. of the whole population, were in a state of pauperism; but in 1848 there were no less than 213,574, or 34 per cent. of the population, that is to say, every three persons supported, in whole or in part, a fourth.

Many of these required only temporary relief, but there were some districts where fully 30 per cent. of the population had to be wholly supported; and in West Flanders 21 per cent. of the whole population were in the same condition. The dreadful state of some communes may be judged from that of the *arrondissement* of Roulers-Thielt, on the 1st of May, 1847, when the proportion of the population whose names were on the relief lists to the remainder who were still able to support themselves, was as 1 to 2·37; that is, for every 237 self-supporting persons, there were 100 paupers.

The extent to which the decline of the linen trade contributed to augment this pauperism, is shown by the fact, that out of 201,760 persons requiring relief in 1848, 90,595 were reduced to that position solely from the inadequacy of their wages. Out of the whole number relieved, were 18,616 weavers, 49,512 spinners, and 14,586 lace workers; or a total connected with the linen industry, of 82,714.

Charitable Workshops.

The National Convention of France, by a law passed on the 15th of October, 1793, proposed to establish, in such localities as were adapted for sedentary work, a workshop or communal hospital, where those who might stand in need of relief, and whose physical condition prevented them from

seeking employment of a very laborious kind, might be provided with tools and raw materials, to enable them to gain a livelihood, and be thus saved from the demoralization of mendicancy. When Belgium was united to France, these workshops, or *Ateliers de Charité*, were introduced into several of its towns; as, for example, Louvain, Brussels, Antwerp, and Ghent. From thence, although but slowly, they spread into East Flanders, where they have continued to exist up to the present day. In 1838 there were 18 such institutions, which afforded support to 1,197 persons. In the winter of 1835-6, 43 towns or communes of East Flanders established workshops. The total expense incurred, including wages paid to those who sought relief, and the purchase of raw materials, was 177,387 francs; the sale of the manufactured articles realized 162,583 francs. There was, therefore, a loss to the extent of 13,804 francs; but with this sum,—that is, with six francs per head—2,165 persons were provided with work during the entire winter, and their independence preserved, who would otherwise have become degraded mendicants. And even in 25 out of the 43, the expense did not exceed two francs, and in some cases was as low as sixty centimes; whilst in four there was actually a profit.

The government has, at various times, encouraged the establishment of *Ateliers de Charité*, and accordingly, within a few years past, their number has considerably increased. In these workshops the strictest economy is preserved, and the inmates are made, as far as possible, to support themselves. With this view, they weave the fabrics required for their clothing, and make their clothes, shoes, hats, &c., besides the articles which are made to order or for sale.

Perhaps the most perfect of these institutions is that of Sleydinge, a village of between 5000 and 6000 inhabitants, in the neighbourhood of Ghent, the chief features of which it will be interesting to mention here.

The inmates consist of—

- 1, the old and sick local poor;
- 2, the deserted orphans;
- 3, those who cannot by their own exertions earn a livelihood, and who are consequently found begging;
- 4, the sick who have no parents or family.

The educational part of the establishment consists of—

- 1, a spinning school;
- 2, a lace school;
- 3, a knitting and sewing school, in which other domestic employments are also taught, and which may be considered a servants' school;
- 4, an elementary school for poor children, and an elementary school for children whose parents pay for them.

The trades and other occupations followed consist of—

- 1, the spinning of tow;
- 2, the manufacture of lace;
- 3, every trade, so far as it can be carried on in the place, which one or other of the inmates is master of, such as shoe-making, tailoring, the making of sabots or wooden shoes, coopers, baking, &c.;
- 4, agriculture.

Attached to the establishment is a small farm of land, part belonging to it, and the remainder rented. The farm operations are performed by the inmates, aided by two horses. The produce of the crops, and of 11 cows which are kept, supply most of the wants of the inmates. The commune and benevolent persons give the remainder.

The general management is vested in a committee appointed by the communal council, and the immediate carrying out of their instructions is entrusted to fifteen Sisters of Mercy; each sister keeps a register of the receipts and disbursements in her department, which is laid before the commissioners every quarter. The whole expense, over and above the value of the farm produce and the profits derived from manufacture, for the maintenance of 142 persons, including sick, children, &c., was 6,300·73 francs, or about £252.

In communes where such institutions have been established, the greatest exertions are made to suppress mendicancy, and the children who receive gratuitous education, are obliged to attend with great regularity. This, according to Doctor Steinbeis, is only a matter of difficulty during the first few weeks after their entrance into the school. The children being only occupied during, at most, two hours in the day with elementary instruction, and the remainder of the time in labour which is remunerative, they soon receive wages, which is a matter of great importance to the parents, who accordingly become themselves anxious that their children should be regular in attendance at school. Thus not only have the children to pay nothing for their education, but they bring home money, or the equivalent of money in food or articles of clothing.

The elementary instruction given in these schools, as Doctor Steinbeis further remarks, has peculiar merits; because, as the school time of each individual does not last long, they can be subdivided into a great number of classes, and the capacities of each duly taken into account. The children can thus be more thoroughly and rapidly taught than in schools where they are crowded in greater numbers, and where they sit together during the long school hours, until the more intelligent lose their energies and get accustomed to idleness.

In all the measures taken by the Belgian government to alleviate the distress of the working classes, they endeavoured as far as possible to avoid mere alms giving, which would only perpetuate the evil while it would degrade and demoralize the people. The report of the commission of 1840 into the condition of the linen trade, having shown, as already mentioned, that one of the causes of the decline of that branch of industry arose from the defective technical education of the work-people, joined with the success of the *Ateliers de Charité*, suggested the idea of getting up similar institutions for teaching, on the one hand, tradesmen generally, improved processes and the use of better tools and instruments; and on the other, for apprenticing a number of young persons to different trades, who would otherwise add to the already sufficiently large class of unskilled labour, and thus increase both poverty and crime. The new institutions were called *Ateliers d'Apprentissage et de perfectionnement*, apprenticeship and perfecting workshops.

Apprenticeship Workshops.

The school established by the provincial council at Ghent, in 1841, with the view of carrying out several suggestions of the commissioners for inquiring into the state of the linen trade, was an institution of this kind, and may therefore be considered as the parent school. The chief object of this school was to teach the best known methods of weaving, but it also afforded an opportunity of determining by direct experiment the relative value of the different new looms then in use, and also of the different processes of preparing the warp, &c. Among the benefits which the establishment of this school conferred, was the more general diffusion of the fly shuttle, which, strange to say, although invented nearly a century before, and known in Belgium during a period of 50 years, was only partially employed in the towns, and was almost unknown in the rural seats of the linen manufacture. The advantages of the substitution of metallic dents in the reeds was also encouraged, by which much greater uniformity in the quality of the fabric was secured. The batten was also made heavier, by which the weft was driven home with one blow to whatever extent the closeness of the texture required. The compressing templet was also substituted for the old one with points, which strained and otherwise disfigured the cloth.

On the establishment then of the apprenticeship schools, by the royal ordinance of the 27th of January 1847, it was but the mere extension of a system which was more or less understood, that was to be carried out. It is a mistake to suppose that a system which has been found to work well in an isolated instance must necessarily do so when applied to a great organization. The individual parts may be well contrived, but the difficulty lies in putting them together. A good system of management was then what was required to secure the success of the project, and this could only result from the comparative experience of several methods.

In West Flanders the government adopted two courses, according to circumstances; in one case the school was directly instituted by the government, who appointed a local commission to manage it, to purchase the raw materials required, and to effect a sale of the manufactured goods; in the other case it confined its exertions to merely fitting up the workshop, and placing it, as in the other case, under the direction of a competent master, the workmen being obliged themselves to procure the necessary material and seek orders or effect sales.

In East Flanders a different system was adopted; the government entered into an agreement with some person, generally a manufacturer, to found a workshop, and to conduct it upon certain stipulated conditions, in consideration of which the State either made a loan or gave a grant of money according to the circumstances of the case. Beyond the right of supervision, which the government always reserved to itself, the contractor was free to manage the institution as he pleased within the terms of his contract,

Experience soon showed that the latter system was the best in practice, as it was also the least in opposition to the commonly received laws of trade, and accordingly it gradually, almost universally, superseded the other system, occasionally, however, it was found desirable to establish a workshop in a

locality where a competent contractor could not be found, and in such cases the government had no other alternative than to undertake the task itself, through the medium of a local committee.

The profit which was realized by some of those contractors soon induced numbers of persons to propose for contracts, even in districts where no one could at first be found to do so. This was not the least valuable result of the workshops, for not only did they develop a supply of skilled labour, but they generated that very species of enterprise and skill, without the assistance of which in a country manufactures cannot grow up. In the latter respect, indeed, many useful enterprises have arisen from the spirit thus evoked.

The foundation of an educational workshop, which, for example sake, we shall suppose is intended to teach some branch of weaving, is very simple. Before describing the manner in which it is done, it is absolutely necessary that we should describe the machinery by which it can be done. Whatever may be said of the Continental central governments, the local ones are certainly superiour to ours in many respects. The government by a mayor and council is not confined to towns, but extends over the whole country. As we have only to do with Belgium at present, we shall confine our observations to it. Besides the central government, consisting of the ministers appointed by the King, responsible to the parliament, each province has a special government, consisting of a governor and provincial council, who perform many of the functions of our grand juries, and similar county boards. Each province consists of a number of communes, each of which has its mayor and sheriffs, or representatives of the executive authority. In the rural districts the commune in almost every case corresponds with the ecclesiastical division which we call a parish, but in the towns it does not, as very large towns containing several parishes constitute still but one commune. The advantages which this system of government possesses for rural districts over the utter absence of all local government in the rural districts of Ireland, must be obvious to all, and has, no doubt, contributed materially in bringing about the successful results which have followed the adoption of educational workshops.

In the establishment of a workshop, the three authorities mentioned are concerned, namely, the central government, which we might term the state, the province and the commune. The idea of the formation of a workshop may originate in two ways; in one case the commune, finding that some branch of manufacture, as, for example, the linen, which had previously been in a flourishing condition, has begun to decline, from the imperfect technical knowledge of those engaged in it, or in order to diminish the pauperism of the district, it may wish to introduce some new branch of industry, would apply to the governor of the province, stating that the commune would be desirous of establishing a workshop, and would give a proper building, and would in addition contribute to its maintenance. The governor would then bring the matter before the provincial council, which we shall suppose to be favorable to the project, and which would accordingly co-operate by voting a certain sum. The governor then brings the matter before the central government, which we shall suppose

likewise sanctions, and allocates to its support a certain portion of the fund voted by parliament for the creation of such institutions. The workshop is then organized by the communal authorities in the manner which we shall presently describe.

In the second case the formation of a workshop may originate directly with some manufacturer, who would wish to revive some sinking manufacture, or to introduce some new one, which unaided he would be unable to accomplish, but who would be willing to do so as the contractor for a workshop. In this case he would write to the governor offering to enter into a contract for carrying on a certain branch of trade, and stating the reasons upon which he founds his belief that the project will be successful, the terms upon which he will undertake the organization of a workshop, and the amount of aid which he will require. The governor then consults the commune as to whether it is in favour of the project, and to what extent it will be disposed to assist. If the reply be favorable it is then submitted to the provincial council, and afterwards to the minister, as in the other case.

When in either case the sanction of these parties has been obtained, a proper building, generally some old store or factory contributed by the commune, which sometimes lights and heats it also, is procured. In this are mounted a number of looms, and the other necessary machines and utensils, of the newest and best construction, supplied at the expense of the government, or at the joint expense of the government, the province, and the commune. The next step is to appoint a foreman, who must not merely be a skilful workman, but one able to inculcate technical instruction, superintend the entire establishment, and maintain discipline. This foreman, who is, properly speaking, an industrial teacher, is employed usually for a fixed term of one or more years. In the case of workshops for females, the function of teacher is also usually performed by a woman. Where the workshop is got up by a contractor, he very often appoints and pays the teacher, and in some instances even provides the building, in consideration of the assistance accorded by the government. These arrangements made, the workshop is ready to commence operations.

The contract between the government and the contractor, when there is one, implies mutual conditions, which must be fulfilled during the period in which the contract remains in force, which is usually for a term of three or five years. The conditions imposed by the government upon the contractor may be briefly summarized as follows:—1, they have to provide constant employment for a fixed number of workpeople, and a supply of the necessary raw material; 2, they are bound to give those workpeople, when they have acquired a certain degree of skill, commensurate wages, the maximum daily hire being fixed, piece or contract work being however permitted to the fullest extent; 3, the admission of new scholars instead of those who leave, after having acquired a satisfactory degree of skill, is left to the judgment of the authorities appointed to control the management of the workshop; 4, a contractor cannot in any case object to the transfer of skilled workers to another contractor, for the purpose of perfecting their instruction; 5, no foreigners can be admitted as apprentices, but may in

the capacity of teacher, whether male or female; they are also bound, in selecting persons for admission, to give the preference to such persons as may be specially pointed out by the local authorities; 6, the contractor, in addition to the fixed number which he is obliged to keep employed in the workshops, is obliged to provide employment in their homes, equivalent to a certain number of looms, stocking frames, &c., for persons who have received instruction in the workshops; 7, the governor of the province may empower any person or persons to visit the workshops, and report upon their condition and efficiency; 8, no other class of goods than those stated in the original contract can be manufactured without the consent of the government; 9, in some cases the proportion of the goods manufactured which must be exported, is prescribed; 10, when the goods manufactured require to be dyed, or to undergo a special process of finishing in a separate establishment, the latter is included in the contract; 11, wherever elementary instruction can be combined with the industrial, the contractors are bound to require the attendance of those under apprenticeship; 12, and finally, the contractors pledge themselves to endeavour to induce the apprentices to participate in the advantage of the system of saving and benefit or annuity funds established by the government.

The government, on the other hand, binds itself—1, to pay a yearly sum as a salary for a proper teacher, provided either by the contractor or by the communal authorities, and for whose final discharge the contractor must, as a general rule, be responsible; 2, to pay a certain sum as compensation for the necessary loss of material attendant upon the instruction of beginners; 3, in those cases where the contractor provides the looms and other plant, to give a supplementary contribution. Where it was necessary to secure the services of a particularly energetic and enterprising undertaker, a loan, at a certain interest, and even sometimes without interest, has been granted. This has been done especially in cases where the erection of dyeing and finishing establishments were found to be indispensable in order to prepare the goods for market.

Any disputes which may arise between the contractor and the government on foot of their contracts are adjudicated upon by the arbitration courts (*Councils de Prudhommes*).

In order to protect itself, the government usually inserts a clause in the contract, setting forth that it would not hold itself responsible for a greater sum than that stated in the contract. In many cases, however, especially in the early stages of the movement, it was compelled to depart from this rule, by giving aid to numbers of persons to enable them to live while making their apprenticeship, and who would otherwise, from not having yet acquired sufficient skill, or from want of adequate food had become weak, be unable to earn sufficient to support themselves. Generally speaking, however, the government was not called upon in this way, as the commune, or private benevolence, was usually adequate to meet the necessity.

In those communes in which workshops have been established by the direct intervention of the government, the management is entrusted to a local committee, appointed by the government, as we have before observed; but even where it is conducted by a contractor, a similar committee is

formed for the purpose of controlling the undertaker, and for the better application of its benefits to the immediate wants of the commune. The mayor of the commune is usually president, and the members in turn, or the whole body together, oversee the workshops. The contractor is bound to submit to this supervision, which, so long as he fulfils his contract, is a decided benefit to him.

In addition to the supervision exercised through the local committees, the government has appointed a provincial inspector in each province, who is the chief of the department under the provincial government, or, more properly speaking, under the governor, to whom he directly reports, and from whom he also directly receives his orders. This inspector is always in direct communication with the local committees, and personally visits every workshop from time to time. They are the soul of the whole of this unique organization, for upon their capacity, energy, and the devotion which they display in their noble but laborious and usually thankless office, depends its success. And truly the manner in which these workshops have been fitted up, and the minute attention bestowed upon their management, reflect the greatest credit upon the Belgian government, the governors of the two Flanders, and upon the zeal and singlemindedness of the two provincial inspectors. Nor must we forget to add, that in almost every instance they have met with a like zeal and devotion in the local committees and the inhabitants generally. A visit to the offices of the governors of the two Flanders at Ghent and at Bruges, where the productions of the Educational Workshops are exhibited, as well as the other arrangements for conducting the business of this department, show, as Dr. Steinbeis well remarks, that as much care is bestowed upon the means of increasing the productive industry of the country, as in the collection of the revenue or the maintenance of justice.

The formation, in the spring of 1844, of provincial central industrial boards, for the surveillance and guidance of local relief and employment committees, has already been mentioned. In the early stage of the system of industrial workshops, it was proposed that these boards, composed of delegates, and under the presidency of the governor, should carry out the organization: with this view the provincial inspector of the province was appointed *ex officio* referendary and inspecting member. It soon became apparent, however, that such boards were not adapted for such a novel and still growing institution, which required a single active and energetic direction. In consequence of the experience of the working of this commission in East Flanders, the formation of a similar one in West Flanders was renounced, while that of East Flanders was allowed to drop into desuetude. In name it still exists at Ghent, but no sitting has been held for three years. On the 13th of March, 1849, the King raised the inspecting member to the rank of independent provincial inspector, an arrangement which has been very successful.

The first organization of the system consisted in the establishment of six work-shops for teaching the weaving of ordinary linen fabrics. This first essay was very successful; the weavers were soon able to earn double their former wages, the goods were also of a much superior quality, and the

distribution of alms to persons able to work almost ceased. Another step in advance was then taken, the manufacture of artistic or fancy goods, such as damasks, muslins, and jacquard fabrics, the use of the jacquard loom being scarcely known in Belgium. Success also attended this attempt, and it was accordingly decided to vary the fabrics, and to introduce, one after the other, the manufacture of a number of articles which had hitherto been largely imported from other countries. In this way a great number of workshops sprung up, in which the manufacture of almost every kind of linen, woollen, cotton, silk, and mixed fabrics were manufactured, except fine broad-cloths, which constitute the trade of Verviers.

As many of these fabrics had not hitherto been made in Belgium, teachers were invited from all parts of Europe; these men, after having fulfilled their contracts, have passed into the service of Belgian manufacturers, and are thus still contributing to educate a new generation of Flemish workmen. The effect of this variation in the products produced, and the introduction of a number of new branches of trade, will materially tend to ward off the greatest danger which threatens the Belgian people, and which has within the last twenty years been the chief cause of the misery which overspread the two Flanders, namely, that when their great branch of industry, the linen manufacture, found no outlet, the greater part of the population would be at once reduced to starvation. Had the workshops been confined to the resuscitation of the linen manufacture alone, the benefits conferred by them would have been momentary, and would perhaps rather lead to a repetition of the disastrous state of things caused by the stagnation of that branch of industry.

It is, however, necessary to observe, that unless under special circumstances, fancy weaving was only encouraged in the neighbourhood of towns, and in densely-populated districts—the improvement of the linen industry being kept in view in the remote districts. The government also judged that it would be unwise to endeavour to spread this branch of industry in thinly-peopled districts where it did not previously exist, or where it had died out, as they considered that it could not thrive there at present.

In the end of 1847, 20 workshops had been established; in 1848, 25 more were added; in 1850 the number was increased by 50. In the commencement of 1853, the total number in operation amounted to 95; of which 2 were in the province of Antwerp, 4 in Brabant, 7 in Hainault, 37 in East Flanders, and 45 in West Flanders. At the end of 1853 and the commencement of 1854, there were only 27 in operation in East Flanders; there were 38 workshops in West Flanders at the same period. The greater number were occupied with weaving, but other branches of industry were also commenced, as, for example, the making of gloves, domestic utensils, nails, &c.

It was in the two Flanders, as will be seen by the preceding statistics, that the system was chiefly developed; but there, too, many of the workshops have been given up. In a very few cases this has occurred from the concern having been mismanaged, or, in other words, from the difficulty of finding a competent conductor; but in the greater number be-

cause private enterprise had sprung up, and rendered them unnecessary. The greater number of them will gradually pass into private hands sooner or later—a result which the government desire to promote, by giving the machinery and tools upon very favourable terms, upon the condition of its being allowed to maintain the system of superior inspection a few years longer.

In order to give our readers a more exact idea of the results of the system of educational workshops, we shall describe the condition of those existing in the two Flanders at the end of 1853.

During the year 1853 there were 27 workshops in operation in East Flanders, which may be thus classified according to the articles made:—

- 5 for the improved manufacture of plain linen fabrics, of all qualities, such as canvass, sailcloth, sacking, tarpaulin, woolpacks, packing cloths, bolting cloths, shirtings, sheetings, huckabacks, russias, crash, &c.
- 2 for the manufacture of damasks, table cloths, diapers, tickens, drills.
- 1 for the manufacture of cambrics, lawns, &c.
- 2 for the manufacture of handspun thread, from 400 to 800 lea, employed in the manufacture of cambric and lawn (called *fil de mulquinerie*).
- 11 for the manufacture of different fabrics of pure cotton, pure wool, and mixed fabrics of wool, cotton, and linen, such as embroidered muslins, twilled cottons, dimities, cotton velvets, plushes, merinos, fabrics for ladies' dresses, tweeds and other trowsersings, vestings, woollen shawls, tartan shawls, fancy plaids, flannels, swanskins, kerseys, baizes, blankets, druggets, doeskins, horse cloths, and travelling rugs; cashmeres of wool and silk, and of alpaca, sewed muslin, carpets, fancy blinds, and window curtains, and other fabrics made by the jacquard loom, &c.
- 2 for the manufacture of silk fabrics.
- 1 for the dyeing of silk.
- 1 for dressing and finishing silk fabrics.
- 1 for hat plush.
- 1 for the cutting of cotton velvet.

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In 22 out of 27 workshops, the industrial operations were conducted by manufacturers who had made special compacts with the government. In five others they are carried on either directly for the account of the workers, or for that of some trader or manufacturer who furnishes the raw materials, without being bound by contract.

The greater part of them are now the property of traders, or are organized in such a way that the pecuniary intervention of the state may be restricted, in proportion as the operations develop and prosper, and be finally in a condition to continue their operations without aid. Already three workshops—those of Wetteren, of Lede, and of Ninove—have ceased to receive any subvention from the state. In many others, the subsidies accorded in the first instance have been considerably diminished. Among those may be mentioned the workshops of Sleydinge, Bellem, Alost, Audenarde, Lokeren, Grammont, Deynze, Leupegem, Eccloo, Evergem.

Those workshops which serve simply as schools where the workmen are admitted in succession to make their apprenticeship, and whose industrial operations are not undertaken by some energetic manufacturers, who commit their position and future to its success, could not necessarily exist

except by means of subsidies from the state, the province, or the commune, as the labour of the apprentices do not produce sufficient profit to cover the salary of the teacher, and the other expenses demanded by the apprenticeship. It is not intended, however, to render such workshops permanent in the same locality, but to transfer them to a new commune when they have accomplished their mission in the locality where they were first established. Thus the workshop established at Grammont in 1849, having fulfilled its mission in that town, has been transferred to Nazereth, a commune having 5,600 inhabitants, a large portion of whom was without work or resources, owing to the decay of the spinning and weaving of linen. In this way aid can be given successively to localities which suffer, of which there are, unfortunately, still a considerable number, without increasing the grants which the state and the province actually make in favour of industry.

The total number of workshops in West Flanders, on the 31st of December, 1853, was 38, which may be classified as follows:—

- 23 were solely occupied in the various branches of the linen manufacture, including sail cloth, canvass, bagging, tarpaulin, glass cloths, huckabacks, russias, sheetings, shirtings, plaited shirt fronts, damasks, diapers, drills, tickens, muslins, cambrics, handkerchiefs, in imitation of Indian.
- 10 were occupied, in addition to the linen manufacture, with the production of various fabrics in pure wool, wool and cotton, alpaca and mohair and cotton, pure cotton; swanskins, cassimeres in wool and cotton, flannels in ditto, fancy trowserings, merinos, fancy plaids, lastings, mixed fabrics for dresses, orleans, paramattas, thibets, nankins, twilled cottons, &c., carpets.
- 3 were occupied in the manufacture of fabrics of pure wool or of mixed wool, and other textile materials, such as tissues of pure wool destined for printing, montpensiers, fancy plaids, cassimeres, barege shawls, fancy trowserings, swanskins, fabrics for dresses, thibets, lastings, light fabrics in pure wool and wool and cotton.
- 1 in the manufacture of silk ribbands, and ribbands of silk and cotton for hat bands, &c.
- 1 for females occupied with Swiss embroidering and other kinds of similar ornamental needle work.

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We have now to speak of the results of the system. It is unnecessary to observe that all the workshops have not been equally successful—the amount of the success depending in a great measure upon the local guidance, the capacity of the foreman or master, and upon the energy and ability of the contractor, where there is one. The character of the local committee is, however, that which would seem to exert the greatest influence upon the results. The testimony of M. Rennier, the inspector for West Flanders, is sufficient upon this point. According to him, wherever the committees have taken up the matter seriously—and, as he takes pleasure in stating, that is the case in the greater number of instances—the workshop prospers; where the committee is indifferent, the workshop languishes. He easily accounts for this from the fact that the majority of the members of the committee live in the commune where the workshop is established; they are in contact with the people, and can act upon them by persuasion, and by the authority which their position gives them, and thus overcome the prejudices which are so much opposed to progress. It

has been already observed that, as a general rule, workshops conceded to contractors succeeded the best. There are, however, many cases where workshops have fully succeeded under the direct management of the government. In such cases, however, a good deal of the success depended upon the patriotism and philanthropy of some one individual who has devoted himself to their management. By whomsoever managed, the direction should not be in the hands of *dilettanti*, but of active, energetic, and singleminded persons, thoroughly understanding the business, and desirous to see it succeed; otherwise workshops of this kind only produce mischief, as several examples in Belgium have proved.

In the following tables we have given a brief summary, in a statistical point of view, of the chief results of the working of the educational workshops during the year 1853, and which, we are convinced, will convey a better idea of their success, than any words of ours could convey:—

Apprenticeship Workshops of East Flanders subventioned by the State.

Nature of Manufacture.	No. of Workshops.	Public aid accorded in 1853.	No. of persons actually employed in workshops.	No. of persons already trained.	No. of cases in which the establishment of a workshop has raised the rate of wages in the locality.	No. of cases in which the establishment of a workshop has led to the creation of factories or establishments for the production of similar articles.
		Francs.				
Plain linen fabrics ...	5	7,085	176	979	4	1
Damask, diapers, drills, &c.	2	2,450	68	302	2	2
Cambrics, lawns ...	1	700	15	50	..	...
Fine linen thread ...	2	1,425	174	452	2	...
Fabrics in pure wool, pure cotton, and mixed fabrics of wool and cotton	10	11,401	307	1,249	8	5
Silk fabrics, including dyeing and finishing, and the manufacture of hat plush	3*	10,500	180	264	1	2
Cutting cotton velvets ...	1	325	...	...	...	...
Total	24	33,886	920	3,296	17	10

Apprenticeship Workshops of West Flanders subventioned by the State.

Linen fabrics of all kinds	23	23,200	490	3,101	22	7
Linen fabrics in conjunction with fabrics in pure wool and in wool mixed with cotton, &c.	10	14,935	406	2,469	8	5
Fabrics of silk and of silk and cotton	1	...	11	9	1	...
Fabrics of pure wool and mixed fabrics of wool and cotton, or alpaca, &c.	3	7,000	139	66	3	2
Embroidery	1	800	27	...	...	...
Total	38	45,935	1,073	5,645	34	14

* Exclusive of a dyeing and finishing establishment.

The remaining 3 workshops, to make up the 27 already mentioned as existing in East Flanders, do not any longer stand in need of state assistance. Two of these, concerning which we have information, employ together 165 persons, and had trained 376 persons up to the end of 1853; in both cases the establishment of the workshops had raised the rate of wages in the locality, and in one case had led to the establishment of a similar manufacture by private enterprise. One workshop was for teaching embroidery, and employed 155 persons, and had trained 300; the other was for the manufacture of linen, and employed 10, and had trained 76.

In the table for West Flanders two workshops have been included which do not now receive permanent assistance from the state; a single sum was given to them in the first instance instead of a yearly grant.

In the two Flanders then there were in the commencement of 1854, 65 workshops in full activity, of which 60 were subventioned by the state; 64 of these workshops had 2,148 persons in apprenticeship, and had already trained 9,317 persons, or a total of 11,465. In 53 localities out of the 65 in which workshops had been established, the rate of wages had been increased in consequence of the workshops, that is, 81·5 per cent. In 25 cases, or 38·4 per cent., the foundation of a workshop had led to the establishment of factories or workshops of the same kind by private enterprise.

The extent to which the improvement in wages took place varied according to the state of depression existing in the locality, the importance of the workshop, and the nature of the manufacture. In many cases the wages of the trained workmen was double, in a few instances even treble, and in most cases at least from 30 to 50 per cent. more than that of the untrained workmen before the establishment of the workshop. Even in many cases where the rate of wages was not increased, the general standard was preserved from further depression. It is worthy of remark, that the elevation of the standard of wages was in most cases in direct proportion to the skill required for the manufacture of the article; thus the improvement was greater in the case of damasks than of plain linens, and, above all, in fabrics made by the jacquard loom.

The influence of the educational workshops upon the development of local industry has been quite as marked as upon the rate of wages. In the table given above the whole extent of this influence is not shewn, for even where no new factories or distinct establishments have been formed, a great impulse has been given to those already in existence, and a number of persons have been provided with employment in their own homes. As an example we shall make a few extracts from the official reports of the provincial inspectors, in answer to the following questions:—

"Has the establishment of the workshop influenced in a visible manner the local industry? Has it appreciably affected the public morals and well being?"

"EAST FLANDERS. Workshop of Sleydinge."—This establishment has had decisive effects on the condition of the labouring class of the commune, which contains about

* Rapport sur les Ateliers—Modèles d'Apprentissage de la Province de la Flandre orientale.

5,200 inhabitants. In 1847 the number of indigent persons requiring assistance from the relief fund (*bureau de bienfaisance*) and alms amounted to 2,200; another part of the population, without being reduced to misery, were in extreme want, and threatened to very largely increase the number of paupers; 24,000 francs were devoted to the support of the indigent. Still this sum was not sufficient, and the misery was frightful. Now a beggar is scarcely to be seen in the commune, and all the good workmen can find employment. The number of persons who received relief in 1853 was 1,648 (the greater number of old persons, infirm, and orphans); of this number 998 only received very temporary relief, and only in consequence of the excessive dearth of food. The expense of the *bureau de bienfaisance* has been reduced to the sum of 11,084 francs, to which the inhabitants in good circumstances added as contributions, or in alms, 5,000 francs. It is easy to conceive, that the sum distributed in the commune as wages by the workshop has visibly influenced the general comfort, and has especially acted upon the position of the small traders, such as brokers, tailors, &c. * * *

"*Workshop of Alost.*—The workshop has influenced in a visible manner the local industry, for other similar factories have been set up, and these in their turn favour other branches of industry, such as the bleaching and the dyeing of linen fabrics, calendering, finishing, &c. All these contributed to the public wealth, and to the general well being, and the more, that the employment which they afford extends to localities in which the working classes were reduced to a state of fatal inaction.

"*Workshop of Eecloo.*—This influence is evident. The establishment of the workshop has given a prosperous impulse to the industry of the town, and awakened among the inhabitants a spirit of enterprize. It has also produced excellent moral effects; the young persons who have made their apprenticeship, and who still do so, accustom themselves to order, economy, and discipline. Instead of being a burden and a danger for society, they are become useful members.

"Two new factories have been established in this town since the creation of the workshop. Since, more than two years, three other manufacturers have taken up the manufacture of the same fabrics as those made by the contractor of the workshop.

"*WEST FLANDERS Workshop of Roulers.*"—Nowhere has the spirit of industry developed itself in the same vast proportions. Since the creation of the workshops a considerable number of industrial establishments have been erected at Roulers. We may mention the factories of MM. Berlaimont, seunr., Vervaecke-Vandekerkhove, Lenoir-Cannoot, Vandamme Brothers, Deys Son, D'Hont, Joseph van Gheluwe, Soenen - Vandekerkhove, Delabeau De Burges, Bonten - Holvoet, Latour-van-Isacker, Moerman-Dobbels, Rodenbach, Mergaert, Rommelacre-van-Holleberke, Leontjens, &c.; without counting the manufacturers who have undertaken the manufacture of articles which they did not make previous to the erection of the workshops. Roulers reckons besides, four spinning factories which are in full activity, and one in process of construction. Power-weaving is also annexed to one of these spinning factories."

These examples could be multiplied if our space admitted of it; we believe, however, that those given, taken in conjunction with all the other facts which we have brought together in the present article, place beyond a doubt the success which has attended the establishment of educational workshops in Belgium. On this point then we shall say no more than quote a few extracts from the official reports as to the general success of the movement.

Mr. L. Wandewalle, the Inspector of East Flanders, says:—

* Rapport sur les Ateliers—Modèles d'Apprentissage de la Province de la Flandre occidentale.

"They have influenced public prosperity; for they have awakened the spirit of enterprise, demonstrated the possibility of reviving industrial labour in Flanders, and provoked the creation of other establishments; the workmen whom they occupy, instead of being a burthen to the inhabitants in good circumstances, have encouraged, especially in the localities where they have been created, the formation of new establishments, resuscitated the retail trade and the labour of the artisans, by the circulation of wages which amount annually to a considerable sum.

"The workshops have also very appreciable moral effects; for they have efficaciously served to combat with mendicity and vagabondage; the local authorities have been able to employ it as a means of repression; liberated criminals have become honest and industrious workmen, and the young persons given up to a fatal idleness, the support of their parents."

Mr. G. L. Rennie, the Inspector for West Flanders, says:—

"After the reading of the preceding reports, we believe that it is no longer possible to call in question the utility of the apprenticeship workshops, as agents for industrial improvement, and for the moral and material amelioration of the population.

"Besides their direct results, one of the advantages of the workshops is also to form excellent foremen, who, distributed afterwards in private establishments, put in practice and propagate the industrial knowledge which they have acquired at the workshop. The foremen who are only acquainted with the manufacture of plain linen, are initiated into the processes of several kinds of manufacture, and all the recent improvements, by passing a few weeks in one of those establishments.

"The great manufacturers of all the provinces appreciate the value of the workshops, and send raw materials to them through their agents. The amount of wages thus annually distributed by one manufacturer of Brussels, in East Flanders, may be estimated at 300,000 francs (£12,000).

"The conclusions to be drawn, in our opinion, from the preceding statements are, that the workshops have largely answered the object proposed by their establishment; they form good workmen, and create new kinds of manufacture hitherto unknown in the localities where they have been instituted. They have resuscitated the linen industry by the diffusion of the best processes of manufacture; they have moralized the working population and ameliorated their material position by labour; they have greatly relieved the relief funds (*bureau de bienfaisance*) from the crushing burdens which weighed upon them, and at the same time improved the financial condition of the communes."

Our review of the condition of the apprenticeship workshops would be incomplete without a statement of the expense at which they were erected. A project may be very excellent in every way, but may yet cost more than the benefits to be derived from its realization would be worth. The following summary will show that the workshop system, judged from this point of view also, has been fully successful. In East Flanders the total expense incurred in the creation and maintenance of workshops from their establishment in 1847, to the 31st of December, 1852, was as follows:—

	francs.	cents.	
Building and purchase of workshops	56,370	26	£2,254 16
Purchase of machines, tools, vessels, &c.	89,441	31	3,577 12
Small moveable necessities	2,331	50	93 4
	148,143	06	£5,925 14
To which is to be added various sums granted or loaned with or without interest to the contractors	150,200	00	6,008 0
Total for plant, &c.	298,343	06	£11,933 14

Of this sum there was contributed by:—

				francs.	cents.	
The State	...	...	...	274,780	62 =	£10,991 4
„ Provinces	...	...	...	6,078	89 =	243 2
„ Communes	...	...	...	9,556	23 =	382 4
Miscellaneous private contributions	...	...	...	7,927	82 =	317 1
				298,343	06 =	£11,933 14

The working expenses for the same period were:—

Rent of workshops	...	...	...	12,943	03 =	£517 14
Compensation to contractors and salaries for literary and industrial teachers	...	...	...	157,123	47 =	6,124 18
Assistance to apprentices until able to earn sufficient to support themselves	...	...	...	39,082	69 =	1,563 5
Purchase of raw materials, &c.	...	...	...	1,498	08 =	59 18
Management and office expenses	...	...	...	5,749	18 =	229 19
Heating, lighting, and sundries	...	...	...	21,125	67 =	845 0
				237,522	12 =	£9,500 17

Of this sum there was contributed by:—

The State	..	...	...	224,569	38 =	£8,982 15
„ Communes	..	...	...	11,700	06 =	468 1
Various private contributions	...	...	...	1,252	68 =	50 1
				237,522	12 =	£9,500 17

The sum contributed by the province was employed in the purchase of apparatus and tools for distribution among those who had completed their apprenticeship. The government also allocated a considerable sum of money for a similar purpose, and a large number of improved tools were thus distributed. For example, from the commencement of the industrial movement up to the year 1851 there were distributed, of

Looms	...	...	...	...	231
Reeds with steel dents	...	...	...	...	2,064
Battens or lays	...	...	...	..	2,064
Fly shuttles	...	...	...	...	3,307
Compressing templets	...	...	...	...	3,140
Metrical reels	...	...	...	...	147
Numerating balances	...	...	...	...	70
Spinning wheels and their adjuncts	...	...	...	...	730

Besides a number of articles required in spinning and lace making, and the establishment of depôts of reeds with metallic dents in various parts of the country. The total sum expended in this way was 116,304 francs 66 cents (£4,652 3s.). In 1853, 5,350 francs (£214) were expended for the same object in East Flanders, and 650 francs (£26) to a manufacturer of Alost, to encourage him to manufacture jacquard looms. The Province of East Flanders also allocated a sum of 2,750 francs (£110) towards payment of the salaries of foremen employed to mount looms and other apparatus in the houses of the workmen.

The expenses of the 24 subventioned workshops of East Flanders for the year ending the 31st of December, 1853, amounted to the sum of 34,586 francs (£1,383 8s.), of which there was contributed by:—

		francs.	
The State	...	27,666	= £1,106 12
„ Province	...	4,050	= 162 0
„ Communes and relief funds	...	*2,870	= 114 16
		34,586	£1,383 8

The expenses in the same province for the year ending the 31st of December, 1852, amounted to 38,022·81 francs (£1,520 17s.)

The total sum expended in East Flanders for the year ending the 31st of December, 1853, was, therefore, 608,473·99 francs (£24,338 18s.), of which there was contributed by

		francs.	cents.	
The State	...	554,823	81	= £22,192 18
„ Province	...	17,373	89	= 695 2
„ Communes†	...	36,271	29	= 1,450 16

A sum less than has been squandered in some Irish Unions during the same time.

The information is less precise with regard to West Flanders, but the following figures will convey an idea of the annual expenses of the system in that province, where the larger number were erected:—

1849	...	...	...	114,943	41	= £4,597 14
1850	...	...	...	81,214	67	= 3,248 11
1851	...	...	...	45,162	75	= 1,806 9
1852	...	...	...	34,000		= 1,360 0 (about?)
1853	...	...	...	45,935		= 1,837 8

Total expenditure for five years ... 321,255 83 = £12,850 4

Apprenticeship Schools (Ecoles Manufactures et d'Apprentissage).

According to the census made in 1840, by the commission appointed to inquire into the condition of the linen trade, which we have already so frequently mentioned, there were in Belgium 280,396 females whose chief means of living was the making of handspun linen yarn; 122,226 of these belonged to the province of East Flanders, 98,383 to that of West Flanders, 33,358 to that of Hainault, 16,730 to that of Brabant, and the remainder to the other provinces. There were besides a number of women who spun at intervals, as a means of supplying some domestic wants. The first victims of the contest between hand and millspun yarns were naturally these females, and already, in the year of the inquiry, they were on the brink of starvation, so that the government had not only to concert measures for employing this immense female population, as well as the thousands of males; but it had also, as in the case of the latter, to look to the future generation, and see that a race of paupers was not produced.

In this case also, the charitable workshops afforded a model upon which to found a system of instruction combined with relief. At that period there existed a number of schools for teaching the working of lace, either in connexion with the charitable workshops, and also many which had been

* Exclusive of the workshops furnished, and the assistance given to workpeople to enable them to complete their apprenticeship.

† Exclusive of the sum allocated for the distribution of tools, &c.

established upon an independent basis; sixty-three of these were in towns, and twenty-one in rural communes. A number of additional ones were set up, under the name of *Ecoles d'Apprentissage*, or apprenticeship schools, which must not be confounded with the *Ateliers d'Apprentissage*, or apprenticeship workshops, which we have above described. These schools are supported in the same way, but not to the same extent, as the workshops, that is, by grants from the state, the province, and the commune, but none of them are, we believe, directly managed by the government, although they are placed under the inspection of the provincial inspector, and their condition and success as much cared for as the workshops.

The workshops are intended for males alone, of all ages, but the apprenticeship of boys is of course that most encouraged in their present stage. The apprenticeship schools are, on the other hand, exclusively intended for girls, who remain in them the whole day, and receive elementary instruction, as well as industrial training. Experience has shown, not only in the apprenticeship schools, and in the charitable workshops, but in the educational workshops, wherever elementary education has been combined with industrial training, that an attendance of about two hours a day for about two years, in the classes, is sufficient to enable a pupil to learn, not only to read, write, and calculate, but to acquire a knowledge of French as well as of Flemish. By the system of small classes described in speaking of the charitable workshops, learning becomes a pastime and a relaxation from the bodily labours of the industrial training; and in this way the lesson is soon looked forward to with pleasure. Children thus receive instruction without being obliged to forego such employment as would enable them to contribute to their support. This system, then, obviates one of the greatest barriers to the education of the poor, who cannot afford to leave their children at school, either because they require them to earn wages, or because they cannot provide them with clothes.

A system of this kind naturally attracted a great number of girls, and schools in great numbers were opened throughout the country, the movement having been greatly assisted by private benevolence. In 1852, no less than 740 such schools existed in Belgium, attended by about 45,000 pupils, chiefly young girls. Of these 363 were under the special management, and supported by private persons; 169 were conducted by religious corporations or convents; 72 by parish priests and curates; 24 by relief committees; and 49 by communal schoolmasters. In the commencement of 1854, there were 342 in East Flanders alone, attended by 22,246 pupils, of which 215 were conducted by private persons; 71 by religious corporations or convents; 30 by parish priests and curates; 26 by local committees, &c. The total aid afforded by the government in 1853, amounted to only 2050 francs, (£82,) and most of them appear to have been in a self-supporting condition.

As lace was almost the sole article made in these schools, this branch of industry rivalled, in a short time, the ancient one of flax spinning. Mr. Wandewalle, the inspector of East Flanders, estimates the number of lace workers in that single province at no less than 40,000. So great an extension of one manufacture, which is besides one subject to great fluctuations from the caprice of fashion, must be looked upon as an evil, and would,

unless guarded against, sooner or later lead to the same disastrous results as followed from the decline of the manufacture of handspun linen yarns.

The government has very properly begun to discourage the further growth of this manufacture, and affords it scarcely any aid; but it has, on the other hand, encouraged the introduction of other branches of industry adapted for women, so as to vary as much as possible the employment of the working classes. Among the employments thus introduced are, the making up of ready-made clothes, shirts, every kind of embroidery and sewed muslin, knitting, fringe, gimp, fine handspun yarn for lawns, sewing of gloves, &c. Out of the 342 apprenticeship schools above mentioned, 63, attended by 5,572 pupils, only were occupied with these new branches, 279, attended by 16,674 pupils, being still exclusively occupied with the working of lace.

The amount of money distributed by these schools has been enormous, and were it not for the fear of such another catastrophe as that above alluded to, and the tendency of parents to compel children of a too tender age to earn wages at such schools, and, among others, boys who should never be employed at sedentary work, their extension would be a blessing to Belgium. We are glad to find, however, that the Belgian government is taking every measure it possibly can to avert these evils.

We have gone as fully as our space would permit us into the examination of the measures taken to resuscitate industry in Belgium. It is impossible to review these measures, or to study their results, without perceiving that the subject is of immense interest in Ireland, and that we may derive many valuable lessons from their attentive study. We purpose in a future number recalling our readers' attention to this subject, when we hope to be able to furnish them with many suggestions as to how we might initiate an analogous movement in Ireland, but one which would be suited to the different circumstances of the two countries.

In drawing up the preceding sketch we have chiefly employed the following works:—

Rapport sur la situation des Ateliers d'Apprentissage et de Perfectionnement dans les Provinces de la Flandre orientale, de la Flandre occidentale, et de Hainault. Présentées à la Chambre des Représentants dans la Seance, du 5 Mai, 1854.

Le Travail Industriel dans le Flandre orientale, extrait de l'expose de la situation de la Flandre orientale pour l'année, 1852. Gand.

Die Elemente der Gewerbebeförderung Nachgewiesen an der Belgischen Industrie. Von Dr. F. Von Steinbeis, Stuttgart, 1853.

Observations au Parlement Belge, par le comité des Honillères de Mons, 1852. Annales du Commerce Extérieur, (Ministère de l'Intérieur) No. 691, Belgique. Faits Commerciaux, No. 8.

Résumé de la Statistique Générale de la Belgique Publiée, par le Department de l'Intérieur pour la période décennale de 1841 à 1850. Bruxelles, 1853.

De l'Industrie en Belgique, par M. N. Briavoinne, 2 vol. Bruxelles, 1839.

We have also to return our most sincere thanks to M. L. Vandewalle, (Chef de Division et Inspecteur des Ateliers Modèles d'Apprentissage, au Gouvernement Provinciale de Flandre oriental à Gand,) and to M. Rennie, of Bruges, who fills the corresponding office for West Flanders, for the kind readiness with which they communicated every information, and for the facilities which they afforded in obtaining access to the various institutions.

ART. II.—*Notices of New Improvements in Mining, Metallurgy, Machinery, Chemical Manufactures, &c., and of Discoveries in general science bearing upon Industrial Arts.*

RAILWAY, NAVAL, AND CIVIL ENGINEERING, MACHINERY, MANUFACTURING TOOLS, AND INSTRUMENTS IN GENERAL.

Anthracite Coal-burning Locomotives.—Mr. Phleger, of Tamaqua, Pennsylvania, has constructed an anthracite coal-burning locomotive which appears to have been successful. The cylinders are 10 inches diameter, stroke 24 inches, weight 25 tons; 4 driving wheels 5 feet diameter, truck wheels 30 inches diameter; furnace 44 inches long by 32 inches wide; the boiler contains 657 square feet of fire surface, 125 tubes 9 feet long by 2 inches diameter. The fire is blown by a fan which is driven by the exhaust steam, and can be used at pleasure while the engine is standing still. The bottom of the furnace is formed by a water bottom with no opening, which is a great feature in Mr. Phleger's improvement; a projecting water way which protects the tubes (the coal never coming in contact with the tubes) forms an air chamber in which gases are consumed.

The cylinders are placed midway of the cylindrical part of the boiler. The height of the top of the boiler is only 54 inches from the rail.

A series of trial trips have been made on the Philadelphia and Baltimore Railroad between Gray's Ferry and the River Susquehanna. The quantity of coal consumed in the trip between both places and back, a distance of 125 miles, was 400 lbs.

Why do not the Directors of the Great Southern and Western Railway and Killarney Junction, both of which lines pass through anthracite districts, make some attempts to introduce the different plans which have been adopted in America to burn anthracite in locomotives. We are certainly very backward in our employment of this fuel.—*Scientific American*, Nov. 25th, 1854.

Valve-gear for Locomotives.—Various devices have been employed for the purposes of operating the valves of locomotives, so as to cut off at any portion of the stroke, and also, to give steam during the whole length of stroke at the will of the engineer. An improvement upon the device heretofore employed has been devised by James Freeland, of Alleghany City, Pennsylvania, the object of which is to transmit motion from the common eccentric to the slide valve, in such a manner that the whole, or a greater part, of the movement of the valve may be performed during a very small portion of the revolution of the eccentric, whereby the full width of opening may be given to the steam and exhaust parts of the cylinder, during a very small portion of the stroke. The rock shaft of the slide valve carries an eccentric arm, which is connected with the valve arm on the common valve shaft by means of a lever and an arc-formed slot, a rocker, and links, all of which are arranged and combined to effect the objects specified.

Improvement in Lathes for Fancy Wood-turning.—Many improvements have been made on lathes for turning irregular forms, and as the business of turning table and chair legs, and other like fancy articles of furniture, is one of great extent, every improvement in such machines must be of interest to those employed in the trade of cabinet-making. An improvement in lathes for this kind of turning has been made by Luther Wentworth, of Burlington, Iowa. In this lathe the stick to be operated on does not revolve as in other lathes, but is moved longitudinally towards and through a revolving hollow mandrel, which carries the cutters to reduce the stick to its proper size and form. The cutters are so arranged as to be thrown in and out of operation, by which the stick can be acted on at intervals at different parts of its length. Near one end of the mandrel there is a saw for cutting off the articles of the proper length from the sticks, as they severally emerge from it.—*Scientific American*.

Oval turning Lathe.—Messrs. Cahoon & Ross, of La Grange Co., Missouri, has made an improvement relating to lathes for turning spokes and other articles of oval shape, which is designed to simplify their construction and render them more

perfect. The nature of the invention consists in providing the face plate of the spindle with a sliding rest in combination with a sliding standard, that its axis can be moved with great facility out of line with the axis of the spindle to stand eccentric thereto, and also the axis of the wood to be turned as it revolves to describe an oval, so that, as the wood comes in contact with a stationary cutter, it will be turned into spokes and such like articles for which the lathe is set. *Scientific American*.

RAW MATERIALS, MACHINERY, AND PROCESSES CONNECTED WITH FOOD, RURAL ECONOMY, AND AGRICULTURE.

PISCICULTURE.—Artificial Spawning Beds.—In connection with the artificial breeding of fish, so ably treated by Dr. Allman in his article in the first volume of this Journal, it may be well to notice some further improvements which have been effected in France. At a meeting of the Academy of Sciences some months since, M. Coste gave an account of some very interesting experiments made by Dr. Lamy in the park of Maintenon, upon an artifice by which all the fish of a pond or of a stream of water might be led to deposit their spawn in the locality assigned to them, from whence they could afterwards be carried to reservoirs, out of reach of all danger.

It appears that such a process is known in China, and that the singular people of that country have been in the habit, from time immemorial, of annually covering the beds of their rivers for a distance of several leagues with mats, upon which the spawn of the fish could be collected and carried to the rivers of the interior. The Romans too appear to have understood this system, at least in the case of the oyster, as is noticed in the paper of M. Coste, on the artificial oyster beds of Lake Fusaro, given at page 44, Vol. I. of this Journal.

Dr. Lamy's method consists in fixing bundles of brushwood to stakes placed close together, so as to form flexible masses, destined to replace the aquatic plants upon which the fish naturally spawn; these aquatic plants should of course be got rid of at the spawning season. These floating masses kept fixed and submerged by a weight, are not long in being charged with ova, which the females come to deposit on the small twigs, and which are fecundated by the secretion from the milt of the male.

Several millions of the ova of the perch and of the roach have already been obtained in this way; other species, such as the carp, are also being operated upon in the same manner.

Researches on Natural and Artificial Fecundation of Fish, by M. Millet.—In order to ensure success in the operation of pisciculture we should approach as much as possible to natural conditions. It was according to this principle that M. Millet, after having studied for many years the habits and instincts of fish, sought to determine the best means of re-peopleing the rivers with good edible species. During five consecutive years, from 1848 to 1854, he made or had made for him numerous experiments on artificial fecundation applied to the rearing of fish; he endeavoured at the same time to see whether it would not be possible to obtain results at least as satisfactory, by approaching as much as possible the natural conditions of spawning so as to render the operations more simple, economic, and certain: he then recommenced his experiments on natural spawning, and compared the results with those of the artificial method of fecundating.

Among the different species of fish we may distinguish: 1, those which spawn in turbulent water or currents; 2, those which spawn in tranquil, dormant, or stagnant waters. To the first category belong the salmons, trouts, (*charr*); in the second, the carp and the tench.

The female trout makes a true nest at the moment of spawning; she chooses a bed of coarse gravel, or of pebbles washed by the clear running water; she stirs and cleans them in order to get out all the fine matter, and all foreign substances deposited by the water. She then digs holes amidst the pebbles, in which she causes her ova to flow, by placing herself a little above them against the current. According as the ova are spawned they are fecundated by the male with some drops of his milt; the female then covers the nest with the pebbles which she displaced.

Spawning grounds may be established in the rivers themselves. If the bed is furnished with coarse gravel or pebbles, these materials may be utilized on the spot; it is only necessary to stir them with a shovel or rake in order to form heaps or little hillocks or banks, with a slight inclination. The establishment of these spawning grounds presents no difficulty, and is attended with only a very slight expense. When the bottom of the stream does not present the proper materials, coarse gravel, pebbles, or stones are introduced. Among other advantages the establishment of these artificial spawning grounds has that of retaining the trout in the stream which it is intended to repeople. This efficacy is so real that M. Millet was able to get trout to spawn in the pits and drains of old turbaries into which some wheelbarrows-full of broken stones employed to repair the roads had been thrown before the ordinary period of spawning.

The Charr (*Salmo umbla Ombre Chevallier*) sometimes spawns at considerable depths (30 or 40 yards). M. Millet had some cubic yards of broken stones and pebbles thrown into ditches 8 to 10 yards in depth; these materials answered as spawning ground for the charr.

For the barbel, the dobule roach, the gudgeon, &c., strands with a slight inclination or heaps or hillocks should be formed in spots where the water flows and is shallow, with stones and the gravel of the river, care being taken to stir and clean the materials with a shovel or with a rake. The river bullhead or miller's thumb and the minnow spawn perfectly in the same waters as the trout, especially in streams and brooks. The young of the bullhead and of the minnow are hatched at the epochs when the salmon fry, the small trout, and charr, &c., are already capable of feeding with advantage upon very small fish whose flesh is still but little substantial.

The river bullhead chooses the stones underneath which are found some cavities in which it glues its eggs in small groups, but it always proceeds with a preliminary labour, which consists in appropriating the place where it wishes to *make its nest*; it then digs a gallery or passage with an entrance and an exit. The female glides under the stone, turns herself briskly on her back and presents her belly to the face of the stone, where she deposits a portion of her ova, which immediately glue themselves to it; the male then penetrates the nest, and by a similar movement to that of the female he squirts, in turning himself on his back, some drops of his milt upon the ova which, are fecundated. The river bullhead guards his nest, and remains at the entrance of the gallery in order to drive away any dangerous animals.

For the carp, the bream, and the tench, the spawning ground should be prepared in a tranquil and fresh water, which the solar rays could render warm. The carp, it may be observed, spawns perfectly in ponds whose water is completely stagnant; moveable spawning beds may be established with the aid of twigs or hurdles, which may be placed close to the banks in a little inclined position, and which could be covered with some clods of grass or rushes.

The perch spawns in a manner perfectly special; its ova soldered together by small groups form a long ribbon, which has the appearance of a pretty piece of lace. This fish has but one ovary, which it empties completely at one time. In a great number of ponds and lakes the ova of the perch is obtained with faggots or twigs plunged in the water. At the period of spawning the perch quits the stream of water and goes to the tranquil localities. These spawning beds are prepared by putting some clods of rushes or of other plants, branches of trees, or twigs; or what is still better, by fixing in the banks, at a depth of about from 20 to 40 inches, some branches furnished with light twigs, as for example those of the willow. It is always easy to gather the ova for it is only necessary to lift the ribbons with a stick, or by means of a small fork.

Artificial spawning grounds applied to the spawning of some cyprins, especially of the bream, and the roach, and to that of the perch, have been employed for the repeopleing of the waters of a great number of localities. Already in 1761, Lund had obtained very good results; for he had succeeded in producing more than ten millions of young fishes.

M. Millet has promised to complete his observations upon this subject subsequently; so soon as he does so we shall present our readers with an abstract.

JOURNAL OF SOCIAL PROGRESS.

ART. I.—*Remarks on a pamphlet entitled "An Examination into the Principles of Currency involved in the Bank Charter Act of 1844, by JOHN E. CAIRNES, Esq., A.M."*

WE feel at liberty to assume that our readers generally are somewhat acquainted with the leading features of the Banking Act of 1844, and especially with the provisions contained in its restrictive sections. According to those provisions the Bank of England is authorized to issue notes unrepresented by bullion, to the extent of £14,000 000. upon Government and other securities, together with additional notes to an extent equal to the stock of gold and silver in its coffers. For example: if its gold and silver treasure should only amount to £6,000,000, the Bank is only allowed to issue notes to the extent of £20,000,000; if its treasure should increase to £16,000,000, the authorized limit to the issues will be £30,000,000, and so on. The authorized amount of circulation varies exactly with the amount of treasure—the only difference between them being, that the former is always fourteen millions greater than the latter.

The authorized circulation, however, must not be confounded with the actual circulation. In practice, the latter seldom comes to within some millions of the former. This is owing in part to prudential considerations, as no bank could be deemed in a safe position without a reserve in hands to provide for incidental calls; in part to unavoidable necessity, as the Bank can seldom find advantageous investment for all its funds; and in part to the circumstance that a considerable portion of the notes that have been put in circulation, are generally returned to the Bank as deposits, and retained as reserve in the banking department. The authorized circulation, therefore, consists of two parts—the actual circulation, and the reserve; the former consisting of the quantity of notes at any given time in the hands of the public; the latter being at all times equal to the amount of notes which the Bank, although authorized to issue, is either unable or unwilling to send into or retain in circulation.

The amount of this reserve, it is obvious, must vary inversely with the urgency of the public demand for accommodation from the Bank. When money is abundant, and accommodation obtainable on easy terms from other sources, the demand upon the reserve will be slack, and the reserve proportionally large. On the other hand, when money is scarce with the public, the demand for accommodation will increase, and the reserve will undergo a corresponding diminution. But when money is abundant with the public, it invariably happens that coin and bullion flow into the Bank in exchange for notes; and when it is scarce, those notes are again returned upon the Bank, and the gold withdrawn from its coffers. It is manifest, therefore, that, as a general rule, when the treasure in the possession of the Bank is large, the reserve will also be large; and when the treasure becomes small, the reserve will suffer a proportionate decrease.

The extent to which the reserve may vary in amount is about ten millions. In theory, the fluctuation might extend to even beyond fourteen millions; as it is theoretically possible that the Bank should either hold its fourteen millions of unrepresented notes, together with a portion of its deposits in reserve, or that it should advance the whole amount in loans, and hold no notes in reserve; but, in practice, the minimum is about two millions, and the maximum ten to twelve millions. The ordinary extent of the reserve is about six to eight millions, but it is never in a state of absolute quiescence, and any alteration in the exchanges will produce a corresponding increase or diminution, according as the change is favourable or otherwise.

This excessive variability in the quantity of the reserve, is the cause of some disastrous evils. One is, that it produces a no less excessive fluctuation in the rate of interest, and thereby in that of the foreign exchanges. When gold is very abundant in the country, and the demand for banking accommodation comparatively slight, the Bank is left in possession of a large reserve, which the Directors know not how to dispose of through the ordinary channels of investment. As this reserve consists of notes that have been issued unrepresented by gold, and which therefore have cost them nothing, they can afford to lend it at a rate of interest much below the ordinary market value. Accordingly, when the reserve is large, they are in the practice of making advances at a very low discount, thereby forcing down the rate of interest to an unnatural level, to the serious injury of all money-lenders, who do not enjoy a similar privilege with themselves. On the other hand, when gold is scarce, both in the hands of the public and the coffers of the Bank, and when a heavy drain sets in upon the notes in reserve, the Directors are often obliged to raise the rate of discount to a very inordinate height, in order to arrest the drain; thereby inflicting a no less serious injury on all who are obliged to borrow. In illustration of the two extremes between which the rate of discount fluctuates under the operation of the present law, it will suffice to mention, that while in 1844, a few months after the passing of the Act, the Bank discounted at the rate of 2 per cent., in 1847—that is, not more than three years later—they were obliged to raise the rate to the height of 9 or even 10 per cent.

A still greater evil, however, than that which arises from the fluctuation of the rate of interest, consists in the fact that, under the operation of the present law, there is a certain stage in the history of every severe drain upon the reserve, at which the Bank has arrived at the end of its resources, and is obliged to refuse any further accommodation to the public on any terms, however inordinate. In practice, this stage is reached when the reserve has fallen to somewhere about the amount of two millions. Experience has proved that the Bank cannot suffer the reserve to fall below that sum, without imperilling its own ability to meet its engagements. Beyond this point, therefore, the Bank is absolutely unable to go, no matter how severe may be the pressure for accommodation, or how great may be the mischief produced by its refusal to make any further advances. And when this stage is reached in any great commercial crisis, the only remedy that remains consists in the temporary suspension of the law—a measure, the necessity of which, is in itself sufficient condemnation of the law that necessitates it.

We have pointed out two of the evils that result from the Banking Act of 1844. One is the excessive variability in the rate of discount produced by the fluctuations in the quantity of the reserve; the other is the inadequacy of that reserve to provide for the case of any heavy drain upon the precious metals, and the consequent inability of the Bank to grant any further accommodation when they have reached the limit which the Act of 1844 prescribes. Of these the former might in degree, but only in degree, be remedied by a very judicious management on the part of the Directors; the latter is an essential result of the present system, and can only be removed or alleviated by an alteration in the law that produces it.

Of these two evils it is the latter that has more especially attracted the attention of Mr. Cairnes in the able and instructive pamphlet which we have placed at the head of this paper, and which forms one of the admirable series of publications that have already issued from the Dublin Statistical Society. The mode in which the writer propounds his views is so lucid, and the pamphlet altogether so opportune, while the probable revision of the Bank of England Charter is looming on the present session of Parliament, that we shall devote a page or two to the analysis of his reasoning, in hopes we may induce any of our readers who feel an interest in the subject, and have not yet made themselves masters of his pages, to avail themselves of the opportunity for doing so, before the subject is presented to the Legislature for discussion.

The first point examined by Mr. Cairnes is the theoretical view upon which the Act of 1844 is based; and the conclusion which he successfully enforces is, that not only is this theory destitute of adequate support from well-established facts, but that the Act itself, in its practical working, is very far from fulfilling the conditions which the theory requires. On both of these points he has the eminent names of Mr. Tooke and Mr. Fullarton in his favour. He then proceeds to the practical aspects of the measure, and opens up the question as follows:—

“First, then :—in what does the perfection of a system of currency consist, and by what criterion are we to judge of its merits? In ordinary times, when commerce moves along in its regular and natural course, there is little room for testing the merits of a currency. It must be a bad system indeed, that in quiet times fails to adapt itself to the business which is required of it. The day of trial does not come till the arrival of one of those seasons of commercial derangement known as monetary crises, when accidental and unforeseen causes defeat the reckonings, and disappoint the expectations, of mercantile men. It is, I conceive, in its power of meeting an occasion of this kind—in its capacity of expanding and contracting, or maintaining its level, according to circumstances, and in such a manner as, while it secures the country against any depreciation from the standard, yet effects this end with the minimum of fluctuation in exchange value, and with the least disturbance to the general machinery of commerce—that its excellence as a monetary system consists.”

A system of currency, therefore, is to be tested by its “capacity of expanding and contracting, or maintaining its level, according to circumstances,” “and with the least disturbance to the general machinery of commerce.” And, tried by this standard, the present system is shown not only to be extremely imperfect, but to be “calculated, in periods of commercial derangement, to intensify every cause of disturbance, and to convert pressure into panic.”

The fundamental error of the system appears to be, that it prescribes a single remedy for a large class of cases, some of which scarcely possess a single feature in common. Whatever may be the cause of a drain of the precious metals, the law enjoins that the authorized circulation should suffer a diminution equal to the amount of the drain. The original intention of the framers of the Act was, that an equal diminution should also take place in the *actual* circulation; but in this respect the machinery of the Act has failed in effecting its purpose. Now, this remedy, if indeed it ever be a prudent one, is only applicable to the case of a drain arising out of extravagant speculation, and general high prices, as it is only in this case that the proximate cause is the unfavourableness of the exchanges; in all cases in which the exchanges are in our favour, the application of such a remedy is not only unnecessary, but extremely mischievous.

The reader must, however, be cautioned here, against a slight but perplexing error into which Mr. Cairnes has fallen in several passages throughout the pamphlet. In the 14th page, he points out very clearly the distinction between the authorized and the actual circulation, and shows that under the present system it is only the former that fluctuates exactly with the amount of gold in the possession of the Bank. And yet, in the 23rd page, as in several other places, he assumes that a contraction of the authorized circulation is equivalent to an exactly similar contraction in the actual circulation, and states that, "in the event of its being necessary to export gold to meet demands for foreign payments, the Act would require that an equal amount of notes should be struck off *the circulation*; that is to say, that if ten millions of gold be sent abroad to pay for necessary expenses, ten millions of notes also should be cancelled." In this sentence, as in the remainder of the paragraph, as well as in some other places, it is evident that he has overlooked the distinction which he has himself so clearly established in the 14th page.

But to proceed. We have said that in all cases in which a large exportation of the precious metals arises from other causes than excessive speculation, the remedy enjoined by the Act of 1844 is not the true one. Accordingly Mr. Cairnes proceeds to show, that whenever the country may be called on to support a large military expenditure abroad, to pay for large additional imports of food, or to incur extraordinary expenses in consequence of a failure in the raw material of any of our staple manufactures, the extensive reduction of the circulation which the Act requires, must not only lead to violent convulsions in the heart of our monetary system, but must also produce grave and disastrous consequences amongst the general community.

A forcible illustration of the truth of the preceding views, is to be found in the memorable crisis of 1847, into the history of which Mr. Cairnes enters in considerable detail. The following contains a *brief* summary of its leading features.

"Well, this 'Cast iron principle,' from which its authors expected so much, was brought to the test of experiment. The years, 1846—47, charged with such formidable events arrived. A concurrence of misfortunes conspired to cause a heavy drain of gold to foreign countries; as fast as the treasure was sent abroad, the screw was tightened upon the currency at home; the result was, that our monetary system underwent a series of shocks and dislocations, such as it had never before experienced, and from which it was at length only rescued by an abandonment

of the principle of the Act, through a direct violation of the law. 'If the law,' says Mr. Samuel Gurney, (a stout supporter of the act when it was passed,) 'If the law had failed only in one case, I should have been jealous of alteration; but we have had three periods of crisis and great difficulty in our monetary system in the last twenty-five months, in each of which I am certain that the calamity and difficulty were materially aggravated by this act. If there had been only one case, I should have wished to try it a little longer; but when we have had three successive cases, one after another, and in each case the difficulty has been materially aggravated by it, I come to the solid conclusion, that the act must be relaxed.' 'I think,' says Mr. Tooke, 'that the whole of the shock to commercial credit, in the latter part of September and the first twenty three days of October, was mainly attributable to the operation of the act.' 'The Bank itself,' says Mr. Horsley Palmer, 'was placed in danger, and the commercial credit of the whole country nearly paralyzed; both which would have been obviated, had the power of extension beyond £14,000,000, then existed on the part of the Bank.'

It will be remembered that the pressure and excitement went on increasing up to Monday, October 25th, on which day the Government letter suspending the operation of the Act appeared. The effect of the letter was instantaneous. Up to the day of its appearance the difficulty of obtaining money was so great that some of the most eminent firms in England were unable to procure accommodation on any terms; and yet within one week after its issue, the currency became so abundant, that the difficulty was no longer how to get money, but how to dispose of it. In the following paragraph the danger which the Bank itself incurred is forcibly shown:—

"But the full extent of the danger in which this restrictive law involved the country, has yet to be stated. The Bank itself was placed in imminent jeopardy. While its reserve in London had been reduced to £1,500,000, the deposits of the London bankers alone considerably exceeded that sum. These deposits might have been called for at any moment; any accident might have led to a demand for them. Now, had these deposits been called for, the Bank of England must have stopped payment; and had this occurred, its notes would have ceased to be legal tender. The effect would have been, that all that portion of the reserve of country banks which consisted of Bank of England notes would, *as reserve*, have become useless; they could no longer have been given in payment of country bank notes. Under these circumstances, there would have been great reason to fear that the whole of the Bank of England notes held at this time by the country bankers, and which amounted to about six millions, would have been returned on the central establishment. Had this taken place, it would nearly have exhausted the treasure in the issue department, which was at this time under £8,000,000; and the remaining £2,000,000 would almost certainly have been carried off in the general confusion and dismay which such a run would have inevitably occasioned. In short, it is the opinion of several witnesses of great practical experience, examined before the Committees of 1848—an opinion confirmed by the Report of the House of Lords' Committee—that nothing but the tardy interposition of the Government saved the convertibility of the note, which the stringency of the Act had endangered."

The last few pages of the pamphlet are devoted to a rapid glance at some of the principles of currency which apply to the present subject, together with a few very general suggestions as to the nature of the changes that should be made in our existing currency code. Mr. Cairnes very justly condemns the views of those who advocate free trade in banking, and shews that the principle of unrestricted competition is inapplicable to the regulation of the currency. He also expresses his approval on theoretical grounds of the restriction of the privilege of issuing notes to a single bank, but from practical considerations is satisfied with the present arrange-

ment, rather than interfere with existing private interests. In this respect we do not altogether unite with him, as we think a suitable arrangement might be made for restricting the issue to a single bank, without inflicting any serious injury on those which should be deprived of that privilege. On the regulation of the issues he thus propounds his views.

"The next point to be noticed is one which appears to me to be of fundamental importance, namely, that in the last resort the issue of notes, whether committed to one or more issuers, should be entrusted to the discretion of some man or body of men. No system of rules, however ingeniously contrived, can, so far as I see, supersede the necessity of this. In the course of the foregoing observations several arguments have been advanced in support of this position, showing that a fixed inflexible rule, laid down without reference to what may be the state of trade and of public feeling in particular conjunctures, is quite incompatible with the preservation of that uniformity of value in the circulating medium, which is one of the first requisites of a good system."

Mr. Cairnes accordingly leans to the view, that in the last resort the regulation of the issues should be left to the discretionary power of the Directors of the Bank of England. While acknowledging that the question is one of great difficulty, and while not professing to offer any decisive solution of the problem, he refers approvingly to the proposition of Mr. Glyn, 'that the whole responsibility of the circulation should be left in the hands of the Bank of England.' To this proposal we believe that very serious objections may be advanced. We think the mode in which the Directors of the Bank of England have dealt with the reserve since the passing of the Act of 1844, as described by Mr. Cairnes himself, in the 9th and 10th pages of the pamphlet, would alone suffice to prove that so great a discretionary power could not be entrusted in their hands consistently with a due regard to the interests of the whole commercial public. It is not to the adoption of so sweeping a measure as this, therefore, that we would look for a remedy to the evils resulting from the operation of the Act of 1844.

We have shown, that two of the more serious of those evils consist in the excessive variability of the rate of discount, produced by the fluctuations in the quantity of the reserve, and the inadequacy of that reserve, to provide for the case of any heavy drain upon the precious metals for exportation. But if this be correct, what we want is a measure that would have the twofold effect, of affixing a reasonable limitation to the variability of the rate of discount on the one hand, and of providing more effectually for the case of severe commercial pressure on the other. The question for consideration is, whether a measure can be proposed that would effect these results, without producing any countervailing evils of its own. For our part we entertain no doubt that such a measure can readily be devised; although our limits at present forbid our entering upon any explanation of the nature of its provisions. The subject, however, is one of high importance to the whole commercial public, as well here, as in England; and we intend returning to its consideration either in the next or some other early number of this Journal. Meanwhile we would recommend the perusal of Mr. Cairnes' "Examination" to all who feel an interest in the subject, and especially those who may not have access to the elaborate treatises of Mr. Tooke, Mr. Fullarton, Colonel Torrens, and the other leading authorities.

TURGOT.

ART. II.—*On the Amendment of the Bankrupt Law in Ireland.**

THE importance, not only to the mercantile world but to the community in general, of a well considered code of law regulating the liability of the insolvent debtor to his creditors, while protecting the latter as much as possible against absolute deliberate fraud, on the one hand, and against the consequences of over trading and imprudent confidence on the other, can hardly be overrated. It is equally true, however, that the attempts at legislation upon this complicated subject in England for a century back, have been almost uniformly clumsy and unsuccessful; and in Ireland, where it has been the fashion to copy English legislation at a distance—as we copy French *modes* (very badly)—without any reference either to principle or to circumstances, we have been accustomed to a corresponding state of confusion in the law, and uncertainty and injustice in the practice of it. The mischiefs of the system have been long felt in both countries. In Ireland the carelessness of the profession for anything but personal advancement, and the utter want of anything worthy the name of public opinion among the mercantile and trading classes, have prevented any step to improvement on our own account, and the Irish public were content to wait the progress of English intelligence, and to accept whatever chance the imperial policy of “assimilation” might gradually bring them. In Ireland, however, the comparatively trifling amount of business, and the comparative cheapness of procedure, prevented the inconveniences of the English system from being felt very materially hurtful, cumbrous, and on principle so many ways objectionable, as it is. In England the multitude and importance of the bankruptcies which are continually occurring in a community so commercial and so enterprising, create a much larger and more vivid interest in the necessary reform of this branch of the law; and for some time back accordingly it has occupied a large share of the attention of her legislators and government.

Before the English Bankrupt Law Consolidation Act of 1849, (12 & 13 Vic. cap. 106,) the various statutes upon this subject in force in that country were so complicated and ill drawn, and the decisions upon their construction so contradictory and doubtful, that it was commonly said among the best lawyers at the English bar, that no safe opinion could be come to in any new disputed case. That Act introduced many changes into the previous system, if system it could be called, and if it introduced among them many altogether mischievous in practice and unjust in principle, it has at least simplified the whole, and made this branch of law somewhat less unintelligible. The Irish Bankruptcy Act, 12 & 13 Vic. cap. 107, passed at the same moment, was an “assimilation” law, framed for the purpose of rendering the Irish practice like that of the English in its intermediate state of development from 1842 to 1849, or before the Consolidation Act; but it included some improvements in the details of practice, taken from the provisions of that enactment while yet under the consideration of the legislature. The mistake in both acts is the common one by which all English legislation for a century back is distinguished;

* On the Amendment of the Bankrupt Law. Dublin: Hodges & Smith, 1855. Pamph. in 82 pp., 8vo.

that the subject matter is considered, not with reference to principles either of justice or convenience, but merely with reference to the previously existing practice of courts, and tradition of legislation, whatever that might be. The too great refinement of judicial decisions, the too great emphasis of the principle of binding courts by the decisions of their predecessors, right or wrong, the too exclusive influence of technical professional learning, and the narrow views which these habits had introduced among professional legislators—narrower and still narrower in each succeeding generation—these are the causes of the ever increasing cumbrousness of English legislation, and of its eminently unpractical character; principles are forgotten amidst a network of mere formulas, and justice in administration becomes almost a matter of mere chance. The history of the former Bankrupt Laws, if we had time to trace it here, would, perhaps, afford one of the most striking examples of what we mean, and the history even of the late improvements in them, examples scarcely less striking. And yet there is probably no subject more capable of complete simplification, none more easily enlightened by clear principles, and none to which practical legislation may be more easily applied.

Many of the practical observations which, with reference to the existing Bankrupt Law in Ireland and in England, we should feel inclined to make in dealing at length with this important subject, have been well developed in an able pamphlet *On the Amendment of the Bankrupt Law*, lately published here, to which the reader interested in the details of the existing law, and the amendments immediately required in it, may be referred. The introduction of a bill to amend and consolidate the Law of Bankruptcy in Ireland, during the last session of the English parliament, supplies the writer of this pamphlet with a reason for undertaking the consideration of the requisite amendments and alterations in that law; and passing over "the principles on which bankruptcy legislation has proceeded," his inquiry is limited to the examination of "the points of difference between the Irish and English systems, with a view to the adoption of those provisions in the English Consolidation Act which appear to be advantageous, and to guard against those which would subvert such parts of our [existing] system as have been found to work well." The writer of the pamphlet then applies himself to the subject from a point of view wholly different from that to which we would seek to turn the reader's attention; his principle is not to look for improvement anywhere outside of the "system" of the English law, but only to assist in patching it up into some tolerable condition of efficiency. He accordingly divides his treatise into observations upon three subjects: the alterations effected by the last Irish act; the Report of the Royal Commission appointed to inquire into the working of the English Consolidation Act of 1849, and the differences between and the respective advantages and disadvantages of the two systems; and the alterations which, in the opinion of the writer, would tend to ameliorate the law in Ireland, and the mode of its administration. And upon these subjects the pamphlet is clear, copious, and practical. The statement in which it sums up the alterations made by the last Act, will best introduce here the nature of the English law by which these matters are at present governed:—

"The principal alterations introduced by the 12th and 13th Vict., cap. 107, are:—

"1. The creation of the office of official assignee.

"2. The power of summoning a trader-debtor on personal delivery of the particulars of demand of the creditor, with a notice requiring payment, and the acts of bankruptcy consequent on default in paying, securing, or compounding the debt within fourteen days.*

"3. The arrangements between debtors and creditors.

"4. The dispensing with the petitioning creditor's bond in £200 to the Great Seal; and the reduction of the petitioning creditor's debt from £100 to £50, in the case of a single creditor; from £150 to £70 for two creditors; and from £200 to £100 for three or more creditors.

"5. The enlarging the class of traders liable to the bankrupt laws; and limiting the time within which the act of bankruptcy must be committed to twelve months prior to the bankruptcy.

"6. The granting power to the Commissioners—to arrest any trader-debtor, on proof of probable cause for believing that he is about to quit Ireland, or remove or conceal his goods with intent to defraud his creditors; to grant search warrants; to discharge bankrupts imprisoned at the time of adjudication; to make orders in certain cases which previously required petitions to the Lord Chancellor; to direct prosecutions for offences under the Act, but upon the request in writing of at least three creditors; to grant the certificate of conformity without the signature of the creditors; to refuse, suspend, or annex conditions to the certificate.

"The effect of these very important alterations has been to render our bankrupt code since 1849 nearly similar to that in England during the period from 1842 to 1849."

The writer also sums up *his* view of the effect of these alterations, by observing with satisfaction that—

"In the mode of its administration, also, the penal provisions have been sparingly resorted to, so that the Court has more the attributes of one for the distribution of the assets of the trader-debtor, and his consequent release, than those of a criminal tribunal. While the name of bankrupt has consequently become by no means so great a reproach as formerly, it must not be supposed that the fraudulent bankrupt escapes undetected or unpunished. On the contrary, fraud and concealment are strictly investigated, and when proved meet with merited punishment."

And he points out two principal defects in the system; first, that the present laws, in consequence of the expense of the proceedings, are not available in the case of small traders, the minimum cost of working a bankruptcy being still under £100; secondly, as the Belfast merchants insist, that in cases of country bankruptcies there is not sufficient provision for a local examination of the bankrupt, his books and papers. That is, that, like English legal administration in almost all other departments, that of the bankrupt laws is cumbrous, expensive, in a large and important class of cases inefficient, and in all practically unbusinesslike.

We shall not follow the writer of the pamphlet through his able examination of the Report on the English law, and of the various causes which had produced so abrupt and enormous a diminution of the business of the court. He has shown clearly that these causes have been chiefly, if not entirely, these four: the restrictions imposed by the Consolidation Act on voluntary bankruptcies, which are not allowed save in the rare case

* "This limit has been reduced to *seven* days in the English Consolidation Act, 1849."

of the trader being able to satisfy the court that at least five shillings in the pound clear will be realized for his creditors; the extravagant expense of the court system, with its fees and allowances at every turn; *the severity of the penal provisions*; the publicity and formality of the proceedings. The first of these impediments is manifestly wholly unreasonable, if any invariable principle be admitted as presiding over this legislation for the public benefit. The second is by no means so desirable in Ireland as in England, because in Ireland the proceedings are much less expensive, and in Ireland indeed even the existing expense may easily be reduced to something very small by a proper reduction of fees, and by providing at least for the salaries of the judges out of the funds of the State, in the manner suggested in another part of the pamphlet. The last two objections are, if they exist at all, of course equally strong in Ireland; but they appear to us to be mistaken, and the mistake appears to have arisen from the inattention of legislators to the *principle* of a bankrupt code, in consequence of which they have inextricably mixed up the morally guilty with the merely unfortunate, and practically reduced poverty and felony to an equal level of crime in eye of the law. We shall not say that this is the only department of the British legislation in which the same result has been instinctively produced, but in this department it is sufficiently glaring to have struck the imagination of our pamphleteer, though he has entirely missed the meaning of what he sees, because he has no eye but for the details and practice of the law.

"When a man is adjudged bankrupt, fraud and concealment are assumed, and he is unnecessarily degraded and treated as a criminal. The messenger and his assistants forthwith invade his house and intrude upon his family; all his effects and furniture are seized; his personal property, even to his watch and his wife's trinkets, are taken from him; his letters per post are intercepted; he is hostilely cross-examined; his past transactions are ripped up, often solely to gratify revenge; his wife may be forced to be a witness against him, and the evidence thus inquisitorially extorted from himself and his wife is afterwards used against him; his means of defence are taken from him, and he is prosecuted at the expense of his own estate; the expense of obtaining his certificate and of appealing against adverse decisions is excessive.

"He is either altogether precluded from obtaining his certificate, or if allowed, it is *absolutely null and void*, should he be guilty of any of the following offences, namely:—

"If he has lost, *at any time of his life*, by any sort of gaming or wagering, in one day, the sum of £20, or if he has lost by gaming in one year preceding his bankruptcy the sum of £200.

"If he has lost within one year preceding his bankruptcy the sum of £200 by any time bargain in government or other stock.*

"If, after an act of bankruptcy, or in contemplation of bankruptcy, or with intent to defeat the object of the bankrupt law, he has parted with, concealed, destroyed, altered, mutilated, or falsified (or caused to be so done), any of his books, papers, writings, or securities;—

"If he has made, or been privy to the making of, a false or fraudulent entry, with intent to defraud his creditors;—

"If he has concealed any part of his property; or if he has suffered a false debt to be proved, &c., &c., &c."

* "This has been held to include railway stock (21 Law I. 18 Bank.) and the loss need not be upon a single, but may be upon several contracts.—20 Law T. 286.

There is another list of (legally "felonious") offences, upon the charge of which the bankrupt is transferred to a criminal court and trial by jury, (in Ireland no prosecution being allowed, save on the demand of three creditors.) but the foregoing matters are determined by the single judge, the Bankruptcy Commissioner; and then followed under the English law a third list of sins, chiefly made so by the intention,—such as the frivolous defence of a creditor's suit, he *having ever during his trade* kept his books imperfectly, carelessly, or negligently, with intent to conceal, &c.—upon which also the Commissioner alone pronounces, (and often hastily and petulantly enough, we know,) and his decision upon which may prevent the bankrupt from ever obtaining his certificate, even after all the expense and exposure and degradation of which he has been made the victim.

We shall say nothing on the subject of the Classification of Certificates under the English act, because nothing can more strongly demonstrate the injustice, the ineffectiveness and confusion of this part of the "system," than the arguments in the Report, and the evidence of the English Bankruptcy Judges, or Commissioners, themselves. The writer of the pamphlet before us deals conclusively with this portion of his subject; but in concluding his sensible observations upon so much confusion and injustice, how can he have missed the true principle to be applied to the whole of it, which he has so nearly stumbled on in this pertinent question?

"Does it not appear obvious that the simple course would have been, to have established a court for the administration of the assets of traders unable to pay their debts in full, committing such as in their passage through the Court appeared guilty of fraudulent conduct to a criminal tribunal?"

Passing over, however, a great mass of able observations, which will, doubtless, earn for the writer of the pamphlet all the consideration he deserves from the public and from future legislators, we shall only make room for his Summary of the Amendments, by the enactment of which, and of a few minor clauses taken out of the English Act, he thinks everything desirable could be secured; premising that each of these "amendments" forms the subject of a section of observations, minute in the information, and always practical in the suggestions they contain:

"Summary of Amendments.

"Consolidation of the law of Bankruptcy.

"The abolishing of Commissions of Bankrupt; giving primary jurisdiction to the Commissioners, and exclusive jurisdiction over all Irish traders.

"The providing means, in a country bankruptcy, for its local working.

"The providing means for the reception of proofs of debt by affidavit before the Registrars.

"The facilitating the voluntary and early cession of his assets by the trader-debtor.

"The amendment of the clauses for arrangements between debtors and creditors under the control of the Court.

"Relaxing the penal provisions.

"Reduction of the fees and substitution of stamps, charging the salaries of the

Commissioners and the compensations on the Consolidated Fund, and providing superannuation allowance for the Commissioners.

"Regulation of the Bankrupt office, and abolition of the Clerk of Inrolments."

If the author of the pamphlet, which has occupied more of our attention here than we had intended, had applied himself to the consideration of the general subject, apart from, as well as in connexion with, that of the practice of the English law, he would have at once found a key to the resolution of all his difficulties. Let us therefore inquire for a moment how the subject has been treated elsewhere; and to take an example from a system of legislation truly philosophic in its structure, and in which *principles* have always been the foundation, let us consider how the Code Napoléon treats the question of Failures and Bankruptcy. It appears to us that it may supply hints the most important towards practical legislation among ourselves.

The *Code de Commerce* carefully separates the ideas of innocent failure and of fraudulent bankruptcy; and it provides cheap and simple means on the one hand, for the trader who has failed, to protect himself against the pursuit of his creditors, and for his creditors on their part to compel him to give up his whole property to be equitably divided among them according to their claims; and on the other, for the punishment of the fraudulent trader whose bankruptcy is tainted with dishonesty and deceit. The 437th Art. defines *Failure*, as distinguished from *Bankruptcy*, to be in the state of a trader who has stopped payment. Every Bankrupt must be in a state of Failure, but every trader who has failed is not necessarily a Bankrupt, because he may have become unable to meet his liabilities without wilful default or dishonesty on his part. But the state of failure is distinguished by this single and only test:—the trader must have stopped payment; and from the moment that he has refused to pay a trade-debt, (*Rivière's Répétitions sur le code de commerce*, p. 474,) or to meet a trade engagement, from that moment, but only then, he is legally in a state of failure. Every trader who finds himself compelled to stop payment is bound to make a declaration of failure to the clerk of the tribunal of commerce of his district, or if there be none in his district, then to the civil tribunal or county court, as it may be termed; and this declaration must be, at latest, on the third day after he has stopped payment. The declaration is accompanied by a schedule of the property of the debtor, his debts and credits, his profits and losses, and his expenses; and this schedule must be certified as true, dated, and signed by the debtor. The Failure must then be declared by formal judgment of the Tribunal of Commerce, and this judgment (which is provisional in the first instance) may be pronounced not only upon the debtor's declaration, but also upon the requisition of one or more creditors, and not only thus, but also by the court of its own authority; by the judgment the moment of the stoppage of payment is declared, or if it be not, it is understood to be that of the declaration of failure by the judgment itself. The judgment is advertised and placarded. The consequences of the judgment are, that from the moment of its rendition, the failed debtor ceases to have any property in any part of his possessions, whether commercial or private; all individual suits by his creditors are consequently

suspended; all securities held as against the debtor become enforceable whether their time has or has not arrived, at least so far as to give these holders a right to appear as creditors, and to take their place in the division of the debtor's property; all interest as against the debtor on foot of debts due by him ceases (though he is liable to pay all such after-accruing interest as well as the principal, before he can supersede his failure). Certain acts of the debtor's after he has stopped payment, or during ten days before it, are made void by law, (Art. 446, et seq.) and certain other acts may be annulled by the Tribunal by which the failure is investigated. By the judgment, the Tribunal (which consists of from 3 to 15 judges, according to the importance of the district) appoints one of its members as Juge-Commissaire—or in our parlance, as a Judge to sit in chamber—to whom the case is referred, and he reports to the Tribunal whenever he has not jurisdiction of himself to decide any special matter arising in the case; in certain instances defined by the law there is an appeal from him to the full court, and the tribunal may at any time substitute any other of its members in his place. By the judgment declaring the failure, the Tribunal orders seals to be set upon the effects of the debtor, and himself to be placed in custody, or under surveillance; but if he has himself made declaration with a proper schedule, the court may make his person free. In all cases the Juge-Commissaire may enlarge the debtor, if on investigation he considers it just to do so, and may take securities for his re-appearance when called on. By the same judgment the court appoints provisional Syndics, in whom the property of the debtor vests, as in the English Assignees, until the meeting of creditors; at that meeting the creditors are consulted, and upon their opinions and the report of the Juge-Commissaire, the Tribunal either appoints other Syndics, or continues the former in their functions. The Syndics make all the necessary investigations into the failed debtor's estate, and close his books in his presence; the personal examinations are conducted by the Juge-Commissaire. They proceed to open the seals, to make inventories, to sell, to recover debts, and to carry on any urgent business of the estate, under the direction of the Judge. Immediately from the declaration of the judgment, creditors may transmit their claims properly scheduled, and accompanied by the original securities, if any, (for the safe keeping of which the officer of the court is responsible for five years,) and these claims are examined, verified, or contested, under the direction of the Judge.

After the lapse of a certain time fixed for the receipt and examination of claims on the part of the different classes of Creditors, the Juge-Commissaire convokes a meeting of those creditors whose debts are verified and affirmed, or provisionally admitted, to deliberate upon the formation of a *Concordat*, or arrangement. To this assembly, at which the failed debtor is present, the Syndics make a formal report upon the failure, and the debtor is also heard. No *Concordat* can be established save by the will of a number of creditors, forming a majority of the entire, and besides this, representing three-fourths of the entire amount of debts proved, or provisionally admitted: neither can there be any *Concordat* in case of a debtor condemned as a fraudulent Bankrupt. The *Concordat* agreed upon must be

ratified by the Tribunal of Commerce, and such ratification makes it binding upon all creditors whatever. Upon this ratification, the functions of the Syndics at once cease. The Concordat replaces the debtor in the management of his affairs as proprietor, and it gives him time to satisfy his debts: it contains such conditions as may be agreed upon by his creditors, but so long as he performs those conditions, and acts strictly according to the Concordat, he cannot be compelled by any creditor to pay his debt sooner or otherwise than as thereby settled, even out of property subsequently acquired by him. The Concordat is on principle irrevocable, but it is revocable by the Court in case of fraudulent Bankruptcy (as where fraud is discovered, or the debtor is found to have squandered the assets, &c.), or in case its terms are not complied with. In case there be no Concordat the Creditors are consulted by the Juge-Commissaire upon the management of the affairs, and the property is sold or business carried on for their benefit by the Syndics; the Creditors are also consulted as to an allowance to the debtor, which is then fixed by the judge upon the report of the Syndics, subject to appeal to the full court.

A trader who has simply *failed* is not therefore treated as a criminal; the law only secures his property for the benefit of those to whom it really belongs, and it does so in a way as little as possible inconvenient to him. If it should turn out that he has acted fairly, he will be mildly treated, and under a Concordat will generally resume the conduct of his business. *Bankruptcy* in the French law, is different. Bankruptcy is either Simple or Fraudulent. *Simple Bankruptcy* is a misdemeanour, punishable by imprisonment; and takes place where the trader's personal expenses are excessive; where he has expended serious sums in operations of chance, whether on change or in commerce; where to delay his Failure he has made purchases to sell again under price, &c.; and where after stopping payment he pays one creditor to the prejudice of the rest. In certain other cases also, when proved, the Court is empowered to declare a trader guilty of Simple Bankruptcy. *Fraudulent Bankruptcy* is a felony, and is punishable by penal labour or transportation: it arises in case of the concealment of books (the trader however being given an opportunity of establishing his bona fides); of the diversion or appropriation of a part of the trader's property; and in case of the fraudulent exaggeration of his debts, by way of collusion or otherwise. In case of Bankruptcy the administration of the debtor's property is conducted exactly as in the case of failure, save that there can be no Concordat in *Fraudulent Bankruptcy*: the prosecution of the Bankrupt is however in all cases conducted in the ordinary courts of Criminal Jurisdiction.

To supersede a failure, the trader must first have paid off the entire of his debts (even those suspended by his Concordat), principal, interest, and costs. Thus only can he be restored to his privileges of citizenship, and to the other rights which he loses by his failure. His *Rehabilitation*, as it is called, is pronounced by the district Court of Appeal, upon his requisition.

Such are shortly the principal features of the French law, which will be found to embrace nearly every advantage and to avoid nearly every defect

noticed by the writer of the pamphlet so often referred to.* We shall not at present inquire into the bearings upon this system of the Commercial Law of France, nor shall we discuss the propriety of encouraging trade by freeing the bankrupt from all future claims, a principle not recognized by the French law. We shall also postpone the consideration of the constitution and practice of the Tribunals of Commerce in France—though on a future occasion we may point out some of the advantages to be derived from their imitation. We have at present simply endeavoured to suggest for the reader's reflection such parts of the French Law of Bankruptcy as appear to us to be not only just in principle and convenient in practice, but easily capable of being accommodated to the ideas and customs which coming from England are prevalent among our mercantile community. The fair trader is protected from any ignominious consequences of an innocent failure—his character is accordingly maintained, and his self-respect remains unshaken; the culpably careless trader is moderately punished; the fraudulent trader incurs the full penalty of dishonesty, robbery, and deceit; but no single judge, nor even the court itself, can arbitrarily condemn a man as bankrupt, or fasten to him a degrading name. It is the criminal court of the country alone that can do this, and only after the usual public trial. The Court which takes cognizance of Failures, has no other jurisdiction than over the property of the debtor, no other powers than those necessary for its protection and management for the benefit of the creditors in general; and this is precisely what alone such a court should be.

The "Consolidation Act," therefore, which we should recommend for Ireland would be one applying these principles to our commercial practice and ideas. We should recommend the adoption of the word *Insolvency*, as one already known and understood, to represent the French *faillite*, or a state of failure; and we should reserve the term *Bankruptcy* to be applied to cases of fraud, or at least of impropriety of conduct, with which that word is already commonly associated, and will continue to be, however an Act of Parliament may define it. *Insolvency* might then be divided into that of the trader and non-trader. The *non-trader* should be simply protected from imprisonment, as at present, or for a limited number of years as in France, by his certificate. The insolvent *trader* should be treated nearly as in the French law above explained; and if it be desirable to limit the now absolute protection from all future claim on the part of his creditors, (an absolute rule which in some cases at least often works at present unjustly,) this class may again be divided into two divisions; the first consisting of those instances in which the failure has arisen from some unavoidable calamity (as in certain cases occasionally occurring of fire, wreck, forgery, &c.), in which the insolvent should be saved harmless for ever; the second of all other cases of failure arising from imprudence or want of success without absolute fraud, in which the future exemption of the debtor might be limited,

* Whenever any attempt at complete legislation is made for us upon the subject, we should counsel the legislator to study carefully the 3rd book of the *Code de Commerce*, and Rivière's *Repetitions Ecrites sur le Code de Commerce*; and to consult the works there referred to, of Pardessus, Becane, Locré, and Rénouard.

in time or otherwise, according to circumstances. The French law of *Bankruptcy* appears to us to be faultless in principle, and might be most advantageously adopted as it stands: the only alterations necessary being those required in respect of the nature of the punishments awarded to different sorts of crimes, differing as these naturally do in every country.

Should the whole subject become again one to occupy the practical attention of such agitators as the author of the pamphlet from which we have quoted, or of the legislators he would influence, the foregoing reflections and suggestions may be found of some use in dealing with the Amendment of the Bankrupt Law in Ireland.

ART. III—Public Baths and Wash-houses.

Return shewing the Number of Bathers and Washers and the Receipts at the Establishments now open in London; and also a few out of the many similar Institutions in the Country, for the Year ending December 30th, 1854:—

District and Title of the Establishment.	BATHS.		WASH-HOUSES.			Total Receipts.
	Number of Bathers	Receipts.	Number of Washers.	Number of Hours Washing &c.	Receipts.	
METROPOLIS.						
1 Whitechapel—the Model	156,158	£ 2,148 19 5	45,124	129,838	£ 887 16 7	£ 3,036 16 0
2 St. Martin-in-the-Fields	127,581	2,099 16 7	42,780	90,614	486 1 4	2,585 17 11
3 St. Mary-le-Bone ..	161,349	2,116 13 7	56,275	105,474	486 5 3	2,602 18 10
4 Westminster—St. Margaret and St. John	103,228	1,283 10 7	62,798	148,807	907 14 9	2,191 5 4
5 Greenwich ..	58,100	806 9 8	7,254	21,009	148 3 0	954 12 8
6 Westminster—St. James	111,471	1,358 17 1	41,116	114,530	788 11 10	2,147 8 11
7 Poplar—All Saints ..	53,186	654 7 10	10,078	47,230	372 14 8	1,027 2 6
8 St. Giles and Bloomsbury	185,964	2,495 18 0	42,796	149,700	1,091 14 1	3,587 12 1
9 Bermondsey, opened June 19	61,899	743 5 2	4,636	17,586	130 3 8	873 8 10
10 Lambeth, re-opened April 2	124,250	1,957 17 6	..	..	..	1,957 17 6
11 St. Pancras—George-st.	77,553	1,396 12 2	128,244	..	796 5 0	2,192 17 2
12 St. George Hanover-Square—Davies st	..	..	..	..	..	..
13 Do.—Lower Belgrave-pl.	..	..	..	..	..	..
Totals for London in 12 mon.	1,220,739	£17,062 7 7	421,101*	..	£6,095 10 2	£23,157 17 9
COUNTRY.						
Liverpool.—						
1 Cornwallis-street ..	134,032	1,977 7 4	..	..	..	1,977 7 4
2 Paul street ..	59,597	763 18 5	14,260	124,577	203 6 8	267 5 1
3 George's Pier Head ..	53,710	1,916 15 10	..	..	..	1,916 15 10
4 Frederick-st. (opened July 24th) ..	..	..	8,115	31,884	149 5 1	149 5 1
Hull ..	59,049	589 3 1	6,766	19,250	88 13 0	677 16 1
Bristol ..	42,082	534 17 1	13,714	22,445	115 6 0	650 3 1
Preston ..	29,528	272 4 8	10,399	30,068	126 4 6	398 9 2
Birmingham ..	101,457	1,639 10 10	4,963	25,457	191 7 11	1,830 18 9
Maidstone ..	33,993	287 0 10	8,948	17,114	97 2 9	384 3 7

* Or the linen of 1,684,404 persons.

IN an article upon this subject, published in the numbers of this Journal for August and September, 1854, we gave a table shewing the number of bathers and washers in all the London baths and wash-houses then

established, and a few of the more important of those established in the provincial cities and towns, and the receipts of each for the year ending the 31st December, 1853 (*Journal of Social Progress*, Vol. I., p. 142). The preceding table, issued by the "*Committee for promoting the establishment of Baths and Wash-houses for the Labouring Classes*," and for which we are indebted to the kindness of the active and obliging secretary to that body, Mr. George Woolcott, contains the similar return for the year ending the 30th of December, 1854.

From this table it will be seen that the movement continues to progress, and that several new establishments have been set up. A comparison of the results for the two years, shows an increase in the number of bathers for the year 1854 over 1853 of 343,040, or 39 per cent, and of washers of 152,061, or 56 per cent. This striking increase is produced, however, by the new establishments, for if we compare the results for the eight establishments existing in 1853, the increase in bathers has been only 79,338, or about 9 per cent., and 19,181 washers, or about 7 per cent. In two of these establishments, the model one at Whitechapel, and the one at St. James's, Westminster, the number of bathers has scarcely varied, in three there has been a decrease, and the number has only increased in two, for we cannot compare the results at St. Giles, which was only in operation during the half of 1853. There has been an increase in the number of washers in two, exclusive of St. Giles, and a decrease in five. If we leave St. Giles out of consideration, for the reason above stated, and compare the results for the seven establishments existing in 1853, with the corresponding ones for 1854, it will be found that there was a diminution in the number of bathers to the extent of 22,816, or about 2·8 per cent, and in the number of washers of 2,564, or about 1 per cent. The greatest diminution in the number of bathers took place in the district of St. Martin's-in-the-Fields, which showed a falling off of 27,837. The greatest diminution in the number of washers took place in St. Margaret's and St. John's, Westminster, amounting to 3,846, where there was also a considerable falling off in the number of bathers, but the diminution in St. Martin's-in-the-Fields was also considerable, amounting to 3,557.

In Liverpool the movement has been eminently successful, the three baths established there had an increase of bathers in 1854 of 58,899, or about 32·2 per cent.; and in the case of the single wash-house attached to the bath in Paul-street, the number of persons who availed themselves of its advantages in 1854 exceeded by 2,420 or 20·4 per cent., the number who washed there in 1853.

We suppose our Irish baths and wash-houses having arrived at the "congratulatory stage," as usual, the committees are resting upon their laurels.

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EDITED BY
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Part II.
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JOURNAL OF SOCIAL PROGRESS.—1854.

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JOURNAL OF SOCIAL PROGRESS.

ART I.—*On the Establishment of a National Gallery of Art in Dublin, and on the means of establishing Permanent Exhibitions of Art in Provincial Cities generally.*

OF all the attractive features of the Great Irish Exhibition of 1853, perhaps the most attractive was the Exhibition of Paintings which filled the Halls appropriated to Fine Arts, and which not only presented a superior collection of Ancient Art, but also afforded, in a very extensive Gallery of Modern Paintings, contributed from almost all parts of Europe, an opportunity, never hitherto rendered possible, of studying the effects of the various modern Schools, and comparing them with one another as well as with those of past generations. It is not surprising that such an Exhibition, so large and so novel in design, and so magnificent in extent, (it included above *a thousand* select Paintings, besides nearly *four hundred* works of Sculpture,)—should have excited so great an amount of public interest not only here but on the Continent,* and in England. And those who have been fortunate enough to have visited frequently the Galleries of that Exhibition have had abundant reason to feel the practical value of such an undertaking in witnessing the delight, not only of the more educated, but also (perhaps even chiefly), of the poorer classes, in making themselves acquainted with the treasures of art thus for the first time placed within their reach. A people who, without the advantages either of high education or of opportunities for the cultivation of taste, could nevertheless answer the silent appeal of the higher Artist by recognizing his claim to silent study and admiration, could not but be benefited lastingly by such an opportunity: and it is a remarkable fact that when the Great Exhibition was opened to the working classes at six-pence, they displayed, in the attention with which they daily examined the wonders of Art before them, an amount of reverence as well as good taste which might well put the richer and more educated crowd to the blush. Not indeed that many mistakes were not made in selecting what to admire: not indeed that much of the superficial, that many of the unideal catch-pictures, did not gain more credit than in the eye of true judgment and pure taste such works are held to deserve. But it was remarkable that no really high work of Art graced the Exhibition Halls that

* The French Government has since determined that the Great Exposition, to be held in 1855, in the capital of educated taste, we may say indeed, of the civilized world—Paris,—should have connected with it a grand exposition of Works of Art, to which all the schools of the world are invited to contribute. In recognizing this effort of the great Celtic nation to realize one of the noblest instincts of the race, we cannot but feel some pride in having set the first example here, among another people of the same stock and the same tendencies of thought and feeling.

did not ever command its circle of attentive admirers, whose earnest and often reverential countenances showed, that while they did not always perfectly understand, they could at least respectfully look up to what was above them, and what they felt contained somewhat of the Spiritual, the Divine. And upon even the least lettered crowd whom Art affects in this manner, Art has already produced much of her highest effect. For to raise men's minds, though but for a few minutes at a time, from the dross of the material world,—to occupy for a little while in sympathy with the Spiritual, which is Eternal, those Souls which in the life of this Earth are but too apt to become wholly entangled in those ephemeral and selfish cares in which man in common with the beasts is interested,—this is the very mission of Art in its very highest sense, as the Civilizer of Mankind.

Few who saw these things in the past summer, and felt in the least the importance of the teaching contained in the Great Exhibition, remembered without something like a pang that it was soon to have an end. As an Industrial Exhibition the undertaking was in its nature temporary, but a universal regret was manifested that the Fine Arts Galleries should be suffered also to disappear, and those who at first felt some doubt of the propriety of associating these with the general Exhibition as one of its departments were generally filled with the desire to make that portion permanent at least. It was but natural then that an attempt should be made to preserve to a people that really seemed worthy of it, a school of taste, in a collection of paintings and sculpture which they had already exhibited so great a capacity to appreciate and profit by. When the prospectus of the *JOURNAL OF PROGRESS* was prepared we had resolved to open this department of its labours with an article upon the importance of National Galleries and of Permanent Exhibitions of Art in general. Even since that prospectus has been in the publisher's hands an effort has been made in Dublin to accomplish this most desirable object, and with so much success that its principal features may be considered now as already executed, and we shall be able before we conclude to offer a practical example, instead of an isolated plan on paper, of the means by which such an undertaking may be brought to completion.

The importance of National Galleries, and of permanent Provincial Exhibitions of Painting and Sculpture, wherever men are congregated in considerable numbers, is not easily to be overrated. They are chiefly important in two ways: first, (and here they may be considered almost as matter of necessity,) in the education of Artists; and secondly, in the dissemination of true taste among the public at large. Without some cultivation of general taste Art in its true sense will fail to make any progress. It is not always the most beautiful, the noblest, and the best of anything that is soonest understood and admired; on the contrary that which possesses the highest qualities ever requires some study and much sympathy for the true understanding of it. At the first glance it may not be strikingly attractive at all, and we have often known persons even of considerable taste and education to be less sensible of the exquisite attractions of a fine *Raffaello* than of works of good but yet very inferior masters in the same collection, until many visits to the Gallery had accustomed the eye

to the picture and its beauty began gradually to steal over the mind. A very high amount of general cultivation of taste seems then to be necessary to the general recognition of works of true Art, and it is only in the midst of a people so cultivated that the Fine Arts can really be said to flourish, such for instance as the people of ancient Greece or of modern Italy. And this general cultivation cannot be produced by mere books or lectures. It is attainable only by accustoming the population to the sight of works of true Art; the population, of whom but a few units possess the means to purchase, even had they the taste to select, such works for their private enjoyment at home, and for whom therefore public collections of Art are absolutely necessary if the required result is to be produced at all. In the absence of such means of general education in a country the Fine Arts languish, even though the dormant capacity and energy of the people be great, and capable under favorable circumstances of effecting much: the professors are discouraged: the schools are neglected: the few works produced at last shew every sign of weakness: the man brought up to call himself an Artist is but a workman, often ignorant even of the use of his tools. The man of genius, if he does ever arise amidst such influences, finds no field for its exercise in times of decay, and he is driven to seek in some more favored country a sphere in which he may fulfil his appointed task in the world. The country which he has left loses his services, and like an ignorant child feels not the extent of its loss. Each must act on the other,—the artist and the people. The artist sinks or disappears where he can find no appreciation or encouragement in public taste, nor can the public taste hope for improvement unless the opportunity be secured to the people of having before their eyes at least some exemplars of pure feeling and high thoughts, of finding in some one spot at least where to breathe an atmosphere of Art.

It is the province and duty of the Artist, through whatever medium he conveys his thought, to express the pure ideal, such as he has strength to feel, so as to harmonize with the times and place in which his earthly lot is cast. The manner of expression suitable to the 13th century may not be intelligible (and if intelligible it may be less appropriate and therefore less effective) in the 19th. It is the artist of the 19th century that *ought* to be able to teach *it* the best. Let him drink in the inspiration of all ages, let not one vivid thought of the past fall dead or lie neglected if it may be, but let him appeal to us also through the externals of our own time, and be assured that in all times and in all places God's world supplies every form which the highest of thoughts can need for a full and just expression. We must then not live only on the past: we must rather seek to encourage the growth of new and yet newer Artists, and we must supply them with what of the inspirations of the past we can, but as examples and incentives to exertion in their own original course. For this purpose it is clear that good collections of works of art of a high class are absolutely indispensable: and well is it worth the while of a nation to strain every nerve in securing such establishments should her exertions secure her even but one among her sons capable of producing new creations for the ennobling of mankind.

Of the two chief reasons above assigned for attributing the importance we do to the establishment of Public Galleries of Art, the first is unquestionably the principal one, if the nation be one whose characteristic tendency is towards the ideal rather than the actual, the spiritual rather than the material, the abstract rather than the concrete. For not only the education of artistic taste but especially the creation and education of artists in such a nation tends powerfully to encourage the development of the leading instincts of the race. And the principal nations or races of the world are very strongly characterized by tendencies or instincts of very different, often of most opposite kinds. It is perhaps the war of taste or feeling inspired by these differences, which keeps asunder nations formed to be naturally friends, because formed each to be the complement of the other: and it is impossible to imagine a greater mistake, (viewing it quite apart,) than the supposition of any real antagonism between such national instincts. Every such instinct may be set down as a characteristic part of a nature moulded divinely by God, and of course designed to work out a good purpose in the world. Properly considered they are only different, not antagonistic; and were the world properly regulated their independent action should be friendly and harmonious, each in fact producing that which its neighbours are not equally powerful to produce as well, but all producing what is desirable if not necessary for all. When God formed men so that so many various races or nations came to be so strongly marked by peculiar tendencies and powers of mind, it is not unreasonable to conclude that He intended to provide for the separate development of the principles represented by them; and we have ever been impressed with a conviction that it is a fundamental mistake to endeavour to force or persuade by laws or systems of education the people of one kind of mental instinct to adopt another as a graft upon it, under the belief that they thereby acquire a new advantage or moderate an extreme tendency. On the contrary each race ought to cultivate to the highest pitch its own peculiar powers and aptitudes, so as to produce for the whole world the utmost possible result in that particular direction; and let Christianity, in fulfilling its mission of peace and true civilization, soothe down the jealousies and hostilities which arise from the blindness of human passion, and gradually bring these separate powers to work out in harmony the improvement of the world. Among those nations whose tendencies and powers lie in the direction of the abstract and the ideal, there let Art be cultivated to the highest degree: it is among such that the education of the Artist is the most important use of a Public Gallery, because it is among such that the highest Artist may be first expected to show himself.

To those nations whose natural bias seeks rather the mechanical, the practical, the material, the establishment of such institutions is of almost equal importance, but chiefly for the second reason: in order to disseminate good taste and pure feeling among the people. Every Christian nation, be it of the one class or be it of the other, recognizes that as Man is not made for this but for a nobler and purer world, so the highest and noblest thoughts which can occupy his mind are those of a spiritual, an *im-material*,

character. Now it is the special object and province of Art to act as a suggestion of the ideal, and to lead the mind towards the spiritual by touching the finer sympathies in expressing something of the harmony of heaven through the beauty of God's creations here. And whenever Art succeeds in awaking even for a moment that chord of Man's nature, it has already for a moment ennobled him, it has for a moment balanced the ceaseless weight of earthly attractions, troubles and interests in his mind, it purifies and strengthens him against being altogether overpowered by the material tendencies in which his animal life is enchained. Among such nations as we last spoke of is there not a greater necessity for the exercise of such a power? And does it not also supply them with the sweetest and most soothing rest in the intervals of their toil? Even so; and to such an extent and with so much good fruit that it seems to be one of the very duties of those whose dispositions incline and whose powers impel them in the direction of Art to employ their energy in supplying their mechanical neighbours with such works as may preach them an eternal lesson of rest and happiness, while they again gratefully enjoy the material and bodily advantages which the ingenuity and ability of these enables them to procure not only for themselves but also for the rest of the world.

There is little need of pointing these remarks, nor shall we delay to show in how many ways the instincts of France and of Ireland (in the mass Celts as those nations are) point clearly and powerfully in the direction of the first, and by how many proofs England, and the kindred States of America, have established a special pre-eminence in material and mechanical improvements. Each may assist the other, of which its genius presents to so considerable an extent the complement. Each should, nevertheless, separately endeavour to push forward towards the highest realization of its own peculiar instincts—towards the highest development of its own peculiar powers. In all countries alike, however, though for somewhat different reasons, it is important to establish Public Galleries of Art in very populous localities; and while in France and Ireland it is the peculiar duty of the nation to afford every facility to education in Art, in the development of the peculiar genius of those nations, in England and the United States, on the other hand, the most efficient galleries ought to find a place wherever trade and manufactures attract the most dense population, and most severely occupy the lives of men, because there precisely is it of the chiefest importance to establish a wholesome counter influence, helping to preserve men's souls from the degradation of sinking to be the mere motive-power of human machinery, less noble than that composed of wood and iron around it.

A suitable collection, for such purposes as we have described, should include, if possible, good specimens of the principal Masters from the 15th century downwards; and it ought, where practicable, to contain representatives of the various nations, if not of the various schools of Art. The characteristics of these are very different, and nothing serves better to enlarge the mind of the student of Art—nothing better to stimulate the taste of the general public,—than to exhibit the prodigious variety of style, materials, composition, and expression, by which Art can express ideas in themselves very similar. The history and progress of Art, too,—its development

and decay in various schools,—is perhaps the most instructive of studies, directed, of course, as the examination of examples ought to be, by proper information respecting them, which may be afforded in the compass of a well compiled catalogue. And in the best collections the more modern schools ought also to be represented, and so disposed as to permit as much as possible the opportunity of minutely comparing those works with the performances of the Older Masters. Where it is impossible to procure good original specimens of the latter class of works certain copies may be well admitted; and first those made by great artists, and by the pupils of the Master under his direction. But the utmost care should ever be exercised in the admission of copies, and in every case they should be conspicuously marked as such. There is, indeed, one class of copy which may be made more extensively available. A great painting appeals to the mind in many ways. The richness of the individual tints, the harmony of contrasted colours, the perspective of colour, and its reflection, constitute a principal charm in Correggio and Murillo, in Titian and in Rubens.—But the same picture may also convey yet higher meaning in the graces of its composition, and the dramatic power of representing vividly a religious, a historic, or a poetic scene. And, lastly, the individual figures may realize the highest thoughts, and the deepest feelings, in the exquisite proportions of their forms, and the touching or sublime expression of their features. Of the latter two classes of artistic language, Michel Angelo, Raffaele, Fra Angelico, Francia, Leonardo, Cano, Murillo, and Zurbaran, offer the grandest examples. Now, these last two classes of pictorial Art may be very adequately repeated by a skilful copyist in neutral tint, or any monochrome, and even in outline drawings more or less shaded; and such drawings, when really carefully executed, will be found of the greatest advantage for educational purposes. Many of the finest works in Europe are, in fact, inaccessible to strangers in any other way, and the noblest of all existing works of Art are of this class. But the chief excellence of the wondrous frescoes with which the churches, convents, and palaces of Italy abound, may thus be brought within our reach also; and so the glorious composition, and matchless expression, of Raffaele's Transfiguration, his Madonna di San Sisto (at Dresden), and other such works, amongst which may be named Murillo's Moses striking the Rock, his Angel Guardian, and his Annunciation—Zurbaran's transcendent Four Doctors of the Church, at Seville—and Alonzo Cano's seven colossal paintings of the Life of the Blessed Virgin, in the Cathedral of Granada—all of these paintings, as priceless as difficult of access, may be made to preach the same lofty truths among the nations of the north, as in Italy, Saxony, and Spain. In all these cases one condition should, however, be strictly enforced; and that is, that the copy be always of the full size of the original, because this condition not only secures the possession of the artist's idea as he himself designed to express it, but offers some guarantee for the correctness of the drawing in detail. The ordinary "trade" copies of smaller size are not only worthless, but worse; they mislead the student, and they injure the reputation, and thus diminish the influence, of the original Master among the ordinary crowd.

In the same manner marbles may be represented by casts, provided they

be really represented; that is, provided the plaster come from a mould fashioned on the original marble itself. There is, perhaps, no such school of drawing as a collection of really fine casts from the greater works of the antique, if they receive proper attention and care. The exquisite casts by Canova, at the Cork Institution (the fact cannot be too often repeated as an example), have been the instructors of most of our best draughtsmen, from MacLise down; and yet in Cork there was no Gallery of Pictures, and no regular means of study were available for the student. In a good collection of casts from the finer Greek marbles, the general public, too, would find an amount of intellectual instruction, perhaps, surpassing anything to be learned from existing pictures; and in those pure and ideal forms, types as they are of but mere human feelings, passions, and powers, will be found some of the highest representatives of beauty, purity, and truth, that have been imagined by the mind of man.

If we admit the great importance of the considerations suggested in favour of the establishment of such an institution as a National Gallery, or (in a provincial city) a permanent public Exhibition of the same nature, the practicability and means of establishing it become the only questions for society to solve. And it has been found by experience that such institutions may, with little exertion, be very widely diffused over a country by local energy alone. In France, where the Fine Arts have long commanded the closest attention as an important branch of general education (a subject upon which, on another occasion, we shall have to take an opportunity of considering in detail), a great number of provincial Galleries of Painting and of Sculpture exist throughout the whole country. These have been very generally the result of local exertion alone—some by subscription, as the Gallery of Casts at Boulogne—some by grants from the Municipality, as (we believe) the Galleries of Marseilles and Lyons—and some by such grants in aid of subscriptions, and finally assisted by the state, as in the instance of the magnificent Musée of Havre.

In Havre the collection of pictures (which is considerable, and includes several valuable works) and casts was gradually, we believe, amassed by the Municipality, and the town possessing, *as usual in France*, a good public Library, and a very respectable Museum of Natural History, a building formed the only desideratum. To accomplish this, as well as to complete the Galleries of Art, the town lately subscribed about £1,600 English; and as the Government had not for a considerable time devoted public money to the improvement of a city so important, a corresponding sum was obtained from the National Treasury. The result has been the construction of one of the most magnificent buildings for the purpose in any provincial city in Europe; outside, too, with the graceful feeling of which the French are so full in recognizing the merits and honouring the memory of their distinguished men in every department, adorned with two fine colossal statues in bronze of the two literary celebrities which the nation owes to Havre—Bernardin de St. Pierre, the novelist and essayist, and the poet Casimer Delavigne.

In our own country hitherto almost nothing has been done in this direction; and in the improvement of the cities of Ireland it is not the practice

of the English Government to permit any expenditure of public money, though so much of it is drawn from Ireland in the shape of tax-tribute, and so much is lavishly expended every year upon London, and in short upon every *English* establishment that requires and demands it. In Scotland (to which the English Parliament accords occasionally a modicum of her proportion of the general funds) a successful movement has been made. There the Royal Scottish Academy had for a long time been forced to depend on the liberality of another institution for Exhibition-rooms, and only a short time since they found it necessary to provide themselves with an independent building. They had long been engaged in collecting pictures to serve as examples in their school of painting, and were possessed of several of no small value, in fact of the nucleus (as we are informed) of a very good collection. It was accordingly resolved that the new building should serve at once for the Annual Exhibitions of the Academy, and as a receptacle for the growing National Gallery; and after a little exertion Scotland obtained, without any difficulty, during the last Session of Parliament, a grant of £15,000 towards its erection. In Ireland, especially after the splendid Exhibition which private enterprise and liberality lately afforded us, we are well entitled to have all facilities accorded for the same purpose, at the expense of the State.* But to be "entitled" to a thing is not in the case of Ireland enough at any time; it never can be, in the relative position of Ireland to its neighbours; and we should probably be the last in Ireland to condescend to beg a portion of what has long been due to us. For public grants for that, as for many other things, we are content to wait till other times (perhaps not so far off either) shall have elevated, or rather restored, this nation to her just place in the community of mankind; and we hail with peculiar satisfaction the independent course taken by the founders of the new IRISH INSTITUTION, the body to which we have made allusion, because it is dignified as well as prudent, and likely to reflect credit on the country by the manner, as well as the matter, of their undertaking.

The example offered by the IRISH INSTITUTION is full of instruction for those who may be desirous to establish anything similar in other places. A few gentlemen, having agreed to something like a general plan, grew into a large and imposing, but very practical, committee, which was established on the 4th November, 1853, under the presidency of the venerable EARL OF CHARLEMONT, "for the Promotion of Art in Ireland by the formation of a permanent Exhibition in Dublin, and eventually of an Irish National Gallery." The nature of the Institution, and the reasons which led to its establishment, are set out in a printed statement, which we shall allow to speak for itself:

"The establishment of a Gallery of Works of Art, including Sculpture and Paintings, (especially those of the best Old Masters,) in Dublin, is not only most

* It is worthy of remark, too, that the buildings and exhibition apartments of the Royal Hibernian Academy were also due to the private spirit of one of its own members. They were erected, and presented to the Academy, by the late Francis Johnstone, P.R.H.A., and largely extended at the expense of his widow.

desirable for the improvement of general taste in a city of its size and population, but it is even essential to the permanent success of Schools of Art in Ireland. It is not probable, however, that any exertions could procure a sufficient sum of money for the immediate *purchase* of a collection of such excellence and variety as would be required in such a Gallery, though by degrees occasional purchases might be made, and though, if a permanent institution of the kind were once founded, many donations and bequests would probably enrich it in the course of years.

"The liberality of so many noblemen and gentlemen, (and not only here but also even in England), in *lending* some of their finest specimens of Art, has enabled the managers of the Great Industrial Exhibition to offer to public view, during those months in which it has been open, a very fine gallery of the Old Masters and many gems of the Modern Schools; and from similar liberality it may be hoped that an excellent substitute for the National Galleries of more favoured countries may be provided, until in better times we shall find means to form an independent public collection.

"A great many noblemen and gentlemen in Ireland, or immediately connected with it, possess fine collections of Paintings, of Statues, and other antique Works of Art, and of the earlier Engravings, and many more have each one or two works of so high a class as to be well suited to a first-rate public collection. If a considerable number of these gentlemen could be induced to *lend* a certain portion of their paintings and other Works of Art of a high class, for a fixed period, (substituting one for another from time to time, so as not to trespass too largely on their collections at any one moment,) a valuable Gallery might be formed, which would at all times supply students with worthy subjects for study, the public with an exhibition calculated to purify and educate taste, and artists themselves with examples for emulation, in the absence of which it is to be feared may be found the reason that many, of high promise in their profession, have produced so little that is really high and able in proportion to the expectations formed of them.

"The annual exhibitions of the British Institution in London show that this plan is capable of being successfully worked, and with the utmost regularity. Artists, students, and the public in London have been long familiar with the advantages, in every point of view, of these exhibitions.

"When it is remembered that Dublin, that Ireland, has no public collection of pictures—that nevertheless striking proofs so frequently offer themselves of the peculiar aptitude of the Irish mind for Art—and, lastly, that the impulse given by the establishment of Drawing Schools, in connection with the Government, is likely to call out and cultivate more than ever before the instincts of the people in this direction, the present seems to be the most suitable moment for the establishment of a Gallery of Art, to remain constantly open to the public. And the close of the Great Exhibition presents, perhaps, the very best opportunity for making a commencement; for not only has its splendid Fine Arts Halls already filled the public mind with a new necessity, and strikingly proved what may be done by the well-timed liberality of the owners of the treasures there shared with the public, but those noblemen and gentlemen—or at least no small proportion of their number—may easily be induced (and several of them have already cordially consented) to leave still in Dublin a portion of the works they have lent to the Great Exhibition during six months of the present year. Placed in a safe and suitable building—of a more secure nature than the temporary Exhibition Hall—no risk can be incurred, and permitted to remain there in proper custody for a certain term to come, a commencement may thus be made much more easily than if this opportunity had not occurred so much in season.

"Such a house or houses as would be suitable for the purpose, pending the arrangements for the ultimate erection of a permanent Gallery, might be had for a rent (including taxes) of from £150 to £200 a-year at the utmost. The expense of repairs, of servants, and of heating (which should be accomplished with the utmost care), would be about a £100 a-year more; another £100 a-year would probably cover the cost of insurance, and of the removal of pictures; and, finally, another £100 a-year, at least, would be required to afford a salary to a proper responsible curator of the Gallery. These sums would reach £500 a-year,

and might be paid from income of two sorts :—1st, The voluntary subscriptions of those who would be willing to pay a guinea a-year for the support of such an institution ; and 2nd, The produce of a small rate charged for admission. Artists and students should have exclusive admission for certain hours of every day ; subscribers, however, of a guinea a-year, donors of ten guineas, or of valuable Works of Art, and owners of Works of Art lent to the Gallery, so long as they should remain there, being always entitled to enter.

“ Eventually it would become necessary to *build* a permanent Gallery, for there is no perfectly suitable building in Dublin. The expense of a proper erection would be considerable ; and perhaps on principle it would be better not to devote private contributions to that purpose, but to apply them to the purchase of valuable Works of Art towards the completion of an Independent Public National Gallery. There are, however, two other ways in which funds might be obtained : the one, by a parliamentary grant ; the other, by a borough rate of one halfpenny in the pound, to be imposed by the Corporation under Wyse's Act (amended by the 13th & 14th Vict. c. lxx., called the “Public Libraries Act, 1850,”) a statute which gave such powers several years ago, but which in Ireland has not yet been turned to account. In either of these ways—even should it become possible by private exertions to raise the amount necessary for the indispensable buildings connected with a Gallery, which must, in the first instance, be altogether without external ornament or pretension—the completion and full architectural decoration of a Gallery really *National*, may be effected at a future period.

“ A permanent National Gallery once established—or even certain to be established—contributions would gradually accumulate, by bequests and donations, of individual Works of Art, in the course of years, and sometimes perhaps of sums of money sufficient to purchase specimens of Art as yet unknown in Ireland. The necessity for having an institution of this kind, in which donors may find a suitable receptacle for their treasures, has been frequently felt, and this consideration appears to furnish an additional reason for taking advantage of the immediate opportunity.”*

The Committee have already met with the greatest success in their labours. The Royal Hibernian Academy have placed their Exhibition Rooms at the disposal of the Institution during the winter, and the first Exhibition of the Institution (consisting of a very noble gallery of ancient art) will have been opened to the public before these sheets are out of the printer's hands. Not only Lord Charlemont, with a great number of other noblemen and gentlemen in Ireland, but also Lord Ward and Lord Yarborough, as well as other gentlemen in England and Scotland, have lent some of their most valuable gems of art to the new Committee ; and the King of the Belgians and M. Van den Berg, of Brussels (a well-known collector) have acted with equal liberality and spirit. But more than this has been done, for a Building Fund has been set on foot, with a view to raise the necessary amount in £25 shares (upon which £1 ls. a year interest will be paid out of the annual income of the Institution), to be

* A note at the end of this statement informs us that “ The committee have appointed Lord Talbot de Malahide honorary treasurer, in whose name an account has been opened at the Royal Bank, Foster-place, Dublin, where subscriptions (£1 ls. a-year), and donations (which, by a resolution of the committee, will be reserved, unless otherwise ordered by the donors, for the purchase of Works of Art for the National Gallery) will be received. Ladies, as well as gentlemen, are admissible as subscribers to the institution. Subscriptions will also be received by Messrs. Craufield, Grafton-street, Hodges and Smith, Grafton-street, Le Sage, Sackville-street, Stark, Sackville-street, as well as by any member of the committee, and communications are to be addressed to the honorary secretaries, George F. Mulvany, R.H.A., and J. Calvert Stronge, Esqs., at Charlemont House, Dublin.

gradually bought up by the Committee out of the surplus of the annual income derived from subscriptions and admissions to the Exhibition. And the finest site in Dublin is likely to be occupied by the proposed erection; that of Leinster Lawn, the scene of the Great Exhibition, in Merrion-square. For this purpose, the Council of the Royal Dublin Society, which rents the lawn from the Right Hon. Sidney Herbert, have resolved, with great good sense and public spirit, to facilitate the lease of the necessary portion of that ground from Mr. Herbert to the trustees of the institution, at a proportionate rent, and they have entered into this resolution without making any reservation or condition whatsoever.

Thus in perfect harmony, and in the most businesslike manner have arrangements of the most effective character been all but brought to a conclusion, so far as Dublin is concerned, for the present. Similar exertions may produce similar results elsewhere, and for the reasons which we have attempted to express, or rather to suggest, in the present paper, we should joyfully contemplate the establishment of such a Gallery in every considerable town. In Cork for one reason, in Belfast for another, in Limerick, Waterford, Clonmel, and Kilkenny, in Drogheda, in Derry, and in Galway, we should be delighted to see a Gallery of Art even beginning with such a one (of casts) as that of Boulogne. But for the present we should not divide our strength: for the present one such establishment in Ireland will occupy our best energies. A temporary Exhibition of borrowed pictures is not a National Gallery, and though it will, please God, lead to one in the end, (and already several valuable works have been *presented* to become public property,) still our progress towards such a consummation must in the nature of things be very gradual, and until that is achieved *all* Ireland should heartily assist in it with all her strength and sympathy.

We have however preferred to treat this subject generally, because upon Art we would write for America, for Scotland, and for England, as well as for our own country. The cause of Art is universal to all Humanity, and exertions in that cause should go on every where in harmony. For us Irishmen a noble mission may perhaps be specially reserved by Providence, to the recognition of which these very exertions may happily lead us. We among the Celtic nations, (whose peculiar bent for Art, for all that is Spiritual, for all that is Abstract, is every where recognized), we alone are powerless in the world for many generations, and in the dark web of European politics it may be for some years useless for us to seek to track out the Future. But in the mean time we have duties ever attending on our powers, and it may be that in the cultivation of high Art among a yet faithful people a weapon may be found more powerful than the Sword, more influential than Fleets, pregnant with grander and happier fruits than those of Wealth, of Commerce, or of Diplomacy, that weapon of civilization which so long made fallen Italy still the mistress of the world, which produces and goes on producing great and the greatest effects even to the end of time, and which in the fame and respect and influence it reflects upon a Nation, may secure too the most powerful encouragement and assistance in the fulfilment of all her earthly Hopes. It is a blessed Dream: may it become one day a Reality!

ART. II.—On the Law of Partnership *en Commandite*.

IN the year 1782 the Parliament of Ireland passed an Act, still unrepealed, (21 & 22 Geo. III., c. 46,) enabling partnerships to be formed on the principles of limited responsibility, like the Continental partnerships *en commandite*. This statute, the provisions of which we shall hereafter consider, has never practically come into operation, one or two companies only having been formed under it. Of late years the question of the adoption in Great Britain and Ireland of partnerships of that description has been very much discussed. It was made the subject of an able report by Mr. Bellenden Ker in 1837, in which he strongly advocated the *commandite* system. It was fully considered by the parliamentary committee on joint stock companies which sat in 1844. The Society in London for the Amendment of the Law have also published a report, concurring in the views of Mr. Bellenden Ker; and the same topic forms the basis of a volume, published in 1848 anonymously, but evidently written by a man of great mercantile experience, in which the writer shows with much clearness, and in great detail, the extreme importance of such a system for giving a healthy stimulus to commerce and manufactures, and checking the ruinous tendency to over-speculation, and consequent panic, now become periodical in England.* He also dwells upon its greater, and almost vital, importance to a country circumstanced like Ireland, where capital is comparatively small and scattered, and mercantile and manufacturing enterprise still in its infancy. As we are persuaded that nothing is more essential to the rising hopes of industry in Ireland than this measure, it is our intention briefly to lay before our readers the defects in the existing law of partnership which it would supply, and the practical benefits which have resulted from its working on the Continent, and in the United States.

An ordinary partnership (as distinguished from an incorporated or chartered joint stock company) may be either general, extending to every trade or business in which the partners engage, or it may be confined to some special business or enterprise. Again, the interests of the partners in the profits may be either equal, or vary in any ratio whatsoever. But there is one consequence common to every partnership, general or special, equal or unequal—namely, that every partner in it, no matter how minute his interest, is liable for the debts and engagements of the company to his very last farthing.

Every person then who embarks in a joint mercantile or industrial undertaking, no matter how small an extent, and no matter how he may wish to limit his responsibility, in reality imperils his whole fortune, and runs the risk of ruin in case of the insolvency of the concerns.

The exceptions to this rule are companies incorporated by Act of Parliament, and joint stock companies, to which letters patent have been

* Partnership *en commandite*, or Partnership with Limited Liabilities, according to the commercial practice of the Continent of Europe, and the United States of America. London: Effingham Wilson. 1848.

granted by the Crown, under the Joint Stock Companies' Act, 1 Vict., c. 73. In these cases, as is very well understood, the shareholders are liable only for "calls" until the amount which they engaged to subscribe towards the undertaking is paid up, and no further. But in every other case, whether the partners be two or two thousand, each of them is liable to the creditors of the company—to use the words of Lord Cottenham—"to his last shilling, and his last acre."

If, therefore, a person be desirous of embarking a *portion* of his savings in some enterprise of commerce, or manufactures, or agriculture, of which he has good hopes, upon the condition of having his proportionate share of the profits if successful, and of losing his venture, and no more, in case of failure, the existing law (apart from the unused statute we have referred to) affords him no means of doing so. His right to a participation in the profits constitutes him a partner, and if he enters into it at all, he must do so on the terms of staking all he is worth in the world upon the result.

It is plain how fatally such a law must operate upon the chances of attracting capital to really hopeful industrial undertakings. It is never by means of such unwieldy machinery as joint stock companies that the resources of a country can be profitably turned to account. The individual eye that sees what can be done, the individual energy and ambition which aspires to do it, and to achieve fortune in the doing, are all in all to such enterprises. But neither talent, nor energy, nor experience, is sufficient, without the command of adequate capital, which, in case of the actual promoters of the undertaking not being possessed of it, can only be obtained either by the almost impracticable method of loan, or by inducing those who have money to invest, to risk all their worldly substance by taking a share in the profits. If, therefore, a plan, the best conceived and matured, for growing flax or making linen in the South, or for starting a manufacture of woollens, or cotton, or earthenware, or for extensive farming or drainage, or for a deep sea fishery, or for working mines, or any other branch of industry whatsoever, and the projectors of it, with facts and figures in their hands, apply not to London millionaires or jobbers, but to local men at home, whom they hope to interest in their project, and say to each of them—"We know you have money looking out for investment: embark in our undertaking, and we will promise you a return of seven, or eight, or ten per cent. Here are our data, examine them for yourself." After examination and reflection, the person so addressed says—"I think highly of your project, so highly that I could be well content to venture £500 or £1,000 with you; but your plan, like all human things, is liable to accidents, and if you fail I am made liable for your debts, and ruined. If you could in any way guarantee to me that my £500 or £1,000 should be the limit of my losses, well and good, I am willing to risk it." Now, this is precisely what can *not* be done under the existing law of partnership here, and what the *commandite* system gives the means of effecting on the Continent, and America.

A partnership "*en commandite*" is one in which, in addition to the managing partners, who incur unlimited responsibility, there are sub-

scribers, or shareholders, who are responsible only to the amount of their subscriptions, and no further.* It is an essential principle in the system, according to the French law, that the commanditaires, or passive shareholders, should take no part whatever in the management of the concern, and an express stipulation to that effect must be contained in the deed of partnership.

By the French law, when persons wish to enter upon a partnership of this nature, it is necessary for them to register publicly an extract, or memorial, of the partnership deed, stating the names and addresses of the active or managing partners, the amount of capital subscribed, and the dates of the commencement and termination of the partnership. It must further state, that there are in addition "commanditaires," or shareholders, specifying their number; but the French law does not impose the necessity of stating the names of the commanditaires, on the ground that it is not to the individuals personally, but to the funds of the company, that credit is given. Any false representations as to the amount supplied is considered as swindling, and punished accordingly.

The terms of the French code defining the nature and consequences of partnership "*en commandite*" are as follows:—

"Partnership *en commandite* is contracted between one or more responsible partners, and one or more partners, who merely advance funds, and who are named *commanditaires*, or partners *en commandite*. It is managed under a partnership name, which must of necessity be that of one or more of the public and responsible partners. When there are several responsible partners, whether the business is conducted by them jointly, or by one or more, on behalf of all, the partnership is at once a *general* partnership† with respect to them, and a partnership *en commandite* with respect to the mere subscribers of funds. The name of a commanditaire partner cannot form part of the style of the firm. The commanditaire partner is only answerable for the losses of the partnership to the extent of the funds which he put, or become bound to put, into the concern. The commanditaire partner cannot perform any act of management, nor be employed in the affairs of the partnership, even by power of attorney. In case of violation of the preceding provision the commanditaire partner becomes liable *in solido* with the general partners for the debts and engagements of the partnership."—*Code of Commerce*, sec. 23-28.

It has been made a matter of considerable discussion in France whether the liability of the commanditaire partner for the funds which he has "put, or become bound to put," into the concern extends to the profits which he has received, as well as the capital originally subscribed. It seems, however, to be now settled, that the liability is limited by the original subscription, and that he is not bound, in any case, to refund profits.

The provision of the code precluding the commanditaire from taking any part in the affairs of the firm has been also the subject matter of much controversy. For example, it has been a mooted question whether a commanditaire can be employed as clerk or servant to the firm. This question

* The word *commandite* comes from *commendare*, which in low Latin means to entrust—hence, benefices held in commendam. The application of it in the present instance arises from the trust which the subscribers, or non-active partners, who are called *commanditaires*, repose in the active partners, who are called *commandités*.

† *Société en nom collectif*.

also appears to be now set at rest, and it is held that a commanditaire can act in such capacity, without forfeiting his privilege of limited responsibility.

Accordingly, the French law, so interpreted, provides a means of giving to workmen and *employés* a substantial interest in the success of the business, which under our law is entirely unattainable. The profoundest thinkers on the subject of the relations between masters and workmen have long felt that the root of the evils to which these relations are for ever giving birth, consists in the absence of any unity of interest between them, or rather in the entire diversity of interest which must exist, where it is the object of the employer to get from his men the greatest possible amount of work, at the least possible rate of wages. In what way to counteract the perpetual clashing of the selfish instincts of masters and men, is the great problem proposed to all countries in which manufacturing industry takes root—a problem the true solution of which is yet, we fear, far off. We are far from saying that the principle of partnership *en commandite* affords of itself an entire remedy; but it gives an opening, and a considerable one, in the right direction.

M. Leclaire, a house-painter, in Paris, about twelve or thirteen years ago, conceived the idea of associating his workmen to himself in the profits of his business, as partners *en commandite*. In a pamphlet published by him, he speaks in the very highest terms of the success of his plan. It renders the workmen not only more diligent, careful, and exact, but by increasing their self-respect in every way raises their moral natures. Other establishments in Paris have followed in the wake of M. Leclaire, and with the same results.

This species of partnership is established not only in France, but in all the Italian States, in Spain and Portugal, in Belgium and Holland, and in all, or nearly all, of the States of Germany. To its beneficial effects most valuable testimony has been given before the Parliamentary Committee on Savings, by Mr. Thomas Wilson, a man of great experience in Continental industrial undertakings, who, to use his own words, “has, since the year 1809, been concerned in almost everything that has been going on upon the Continent of Europe, where there has been a shilling to be gained: in all kinds of contracts of industry, speculations in the funds, in dyking rivers, and everything where anything could be gained.”

His evidence is to the following effect:—

That most of these operations have been carried on under societies, and by limited liabilities *en commandite*.

That he has tested the beneficial working of the system of limited responsibility in the large transactions of which he had experience in Holland: that it tends to bring persons of prudence and caution to take part in enterprises of this nature, which they would not do if responsibility were unlimited.

That, under the law of limited liability, enterprises are carried out successfully by circumspect men, and to the great advantage of the community.

That such enterprises so conducted, and carried out, afford good investments for the savings of the humble and middle classes.

That such societies in Holland are numerous, and have carried out very extensive works in the reclaiming of land from seas and rivers. That in his own time there has been gained from the Scheldt two or three hundred thousand acres under the working of a law of limited responsibility, these works being undertaken by capitalists, *along with* the local people, whose local knowledge, as well as their individual industry, is of immense importance, and whose interest is bound up with the success of the work, by their having shares under the *commandite* system; and that this mode of investment is popular with the humble and middle classes in Holland, whose people are remarkable, as well for their industry, as for their care and caution, in the undertakings they enter into.

That the use made of the system is by no means, however, confined to these classes, all ranks taking part in industrial undertakings as investments for money, and the King of Holland himself being an extensive *commanditaire*.

That he has found it work no less successfully in Belgium than in Holland, most of the collieries in Belgium having been worked *en commandite*; and that there also it has been found to induce persons of cautious, circumspect, and careful habits, to take shares in partnerships, which they would be prevented from doing if their whole fortune was liable.*

But it is not alone on the Continent of Europe that this system has been worked with such beneficial results. It has been adopted into the codes of nearly all the American States. By the code of New York, it is provided, that—

“Limited partnerships for the transaction of any mercantile, mechanical, or manufacturing business, within this State, may be formed of two or more persons, upon the terms, with the rights and powers, and subject to the conditions and liabilities herein prescribed; but the provisions of this title shall not be construed to authorize any such partnership for the purpose of banking or making insurance.

“Such partnerships may consist of one or more persons, who shall be called general partners, and who shall be jointly and severally responsible as general partners now are by law, and of one or more persons, who shall contribute in actual cash payments a specific sum as capital to the common stock, who shall be called special partners, and who shall not be liable for the debts of the partnership beyond the fund so contributed by him or them to the capital.

“The general partners only shall be authorized to transact business and sign for the partnership, and to bind the same.”

The code then proceeds to set forth special provisions for the regulation of such partnerships, in the main agreeing with, but in some respects differing, and we think unfavourably differing, from the French law.

We purpose on another occasion to consider those provisions more fully, as well as those of the abortive Irish statute, showing what alterations in the latter would permit the easy working of the system amongst us, and to deal with the objections which have been made to the *commandite* system on the grounds of supposed injustice to creditors, and alleged tendency to facilitate fraud.

* See evidence of Mr. Wilson before the Committee on Savings.—*Parliamentary Paper for the Year 1850*, vol. 19, p. 37.

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ART. I.—*On Art-Unions.*

THE nineteenth century contrivance for the encouragement of Art is characteristically tradesmanlike, something between a lottery and a joint-stock company, the machinery which goes by the (German) name of an Art-Union. In the middle ages, and even down to within a century ago, it was the rich man or the wealthy corporation, the prince or the magistrate, the emperor or the republican municipality, that gave the artist an opportunity to teach mankind. In those ages individual faith and feeling was earnest and strong, and struggled vehemently for expression; the ideal was practically regarded as superior to the actual; the several men whose aggregate made up society did not lose their several identities in the crowd, or surrender their separate instincts and characters to the rules of fashionable conformity. In those ages, too, nationality was powerful and real: whether its form was royal, imperial, or republican, the faith of Nationality, and the allegiance to that faith, in prince, magistrate, and people, was vivid and loyal. The expression of such feelings and of such faith—among the highest of which human nature is capable, and so often too deep for words—was naturally made in the forms supplied by Art: by Art in all its branches,—Music, Painting, Sculpture, and Architecture, but chiefly perhaps in Painting; and in all times, and in every country at all capable of artistic development, such feelings, existing as they will ever continue to do, with more or less purity and force, will seek utterance through the same vehicles of expression. Probably, (we may be at least permitted to hope so,) probably we have in the aforesaid nineteenth century, reached at last the very nadir of manly feeling and of national faith, and that we may expect at least some improvement. Indeed it would seem that some signs of it begin to show themselves, during the past few years, in the political world, though as yet with no substantial result. And in the province of Art, the most valuable instrument and expression of true civilization, after Religion itself, it is fit that we should address ourselves to prepare the way for that healthy action of development which has disappeared for above a century in most parts of Europe, which here in Ireland can scarce be said to have begun to exist at all during the short span of our too dreamy national independence.

In the dearth of works of high art and of real artists since the middle of last century, the public taste gradually decayed, and for a considerable time so little was the encouragement to the artist that few men of competent ability dared to follow a profession so precarious. But the peculiar

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province of the Artist is to lead civilization, not to follow its march; to inspire ideas, not to receive them from the crowd; to teach and to command men's minds, not to submit to the demands of ignorant fashion. And only the able man, only he who possesses genius and insight as well as technical power of expression, can possibly perform such a mission. When such men accordingly are deterred from entering on the sphere of Art, no noble works will be produced, no improvement can be expected in public taste; and as public taste falls lower and lower, the tradesman, the most unimaginative panderer to the depraved and senseless appetites of the vulgar eye, usurps and enjoys the name and reputation of an "Artist." It is important to grasp at any means of effecting a change in such a state of things,—and this is *our* state in the middle of the nineteenth century. The first necessity then is to provide such encouragement for the production of works of Art as will invite able and gifted men to devote themselves to its study and profession; and if any Art-Union will healthily subserve to this end, it is a matter of no mean national importance to give it the most substantial support. We shall find, on inquiry, that some Art-Unions have proved capable of producing such an effect.

The general plan of an Art-Union is too generally known to need description. These establishments originated, we believe, in Prussia, and rapidly spread not only over great part of Germany, but also into Italy, France, and Belgium. The United States, England, and Scotland copied them from those countries, and it is now several years since a similar institution was established also amongst ourselves, of which we shall presently have occasion to speak. These various associations met with various success, those that were moderately well managed attracting a very great number of subscribers, and through their instrumentality immense sums of money have been annually distributed among painters, sculptors, and engravers, throughout Europe and America, during many years.

The proposed object of the Art-Unions was the general dissemination of Works of Art among the people. Their effect has been (everywhere except in Ireland) to offer to professed Artists the encouragement of ample annual markets, and thus to prompt them to greater and greater exertion. An immense number of very bad works have, it is true, been distributed; and there can be no doubt that the degradation of public taste has been, must necessarily have been, increased by such a distribution. However, on the other hand, the cause of Art itself, to look a little farther, will be advanced if that indiscriminate encouragement stimulate but a few of the gifted men of genius to become Artists, but a few of the true Artists to produce really noble and lasting monuments of their power. And it is certain that in some parts of the Continent this effect has been realized; eminently, for example, in Belgium, where the prodigious activity of the schools (bearing already fruit so admirable as to begin to vie with the past), has produced works of so great excellence in the higher walks of Art, as, for instance, the masterly group by DE KEYSER (Saint Elizabeth of Hungary distributing charity), now in the Exhibition of the new Irish Institution, in Abbey-street, and lately among the most universally admired paintings in the Hall of the Great Exhibition. The success of the

Belgian Schools of Art could not have been attained by good Academies alone, even with all the encouragement of profuse national assistance; it could hardly even have been secured by the liberal public support which attends on Art in Belgium. So many individual triumphs required a still greater demand, a larger and more universal market for Works of Art, for this alone could tempt men of active energies and aspiring minds to devote their powers in this direction. That market the Art-Unions there certainly supplied, and as in almost every city of Belgium the remains of her former glories are still rich in artistic splendour, as yet unequalled in more modern times, the standard of excellence is naturally high among a people accustomed to see chefs-d'œuvres everywhere around them, and those who sought fame and reward felt compelled to emulate their predecessors. In this manner the extension of Art-Unions has greatly benefited Belgian Art, and in doing so has increased the general desire for its dissemination; while good examples, good schools, and the healthy sympathies of a people prosperous and free, and proud of the Past, afford the best guarantee for the permanence of its progress.

Such is, we believe, the state of facts in Belgium, and such, to a great extent, is the state of facts in respect of Art-Unions in most of the other countries in which they have been established.

In a country circumstanced like ours, it is true that success so sudden as that which has taken place elsewhere cannot be looked for, because the few Artists whom the miserable circumstances of our provincial degradation permit to raise their heads, too generally seek for refuge in some other land, more prosperous in worldly wealth, or less deeply plunged in the bitter ruin of all manly life and hope which darkens the whole surface of our monotonous existence in Ireland. But so surely as there is a way out of this state of things, under God, (and it were to deny God's providence to doubt it,) so surely the eye of true genius will pierce into the future to see there the way of deliverance, and his heart will rejoice, and out of his abundant and loving faith he will pour forth consolation to his fellow countrymen. Who may so purely teach us, who so nobly exhort us, as the Artist, plunged in the pursuit of the Ideal, the Beautiful, the True; his Poet heart deeply and piously filled with devotion and love towards the Fatherland? Most earnestly should we long for that sweet though silent teacher. Most anxiously should we hail his coming. Most diligently should we prepare the way for him, nor neglect any means whatever to welcome and honour him. But the peculiar tendency of Irish spirits make us singularly easily saddened to despair, and many a gifted son of Ireland, even with the thoughts of truth and nobleness in his young heart, has allowed himself to be sickened at the dark prospect around him, amidst an ill-educated people, benumbed into blindness, and apparently incapable of sympathy. Many such a one has fled in despair from the scene, and striven, and successfully striven, to forget his identity, all his young ambition, his pure young hopes, among the ideas, the manners, and opinions of a stranger race. And so generation after generation passes away unawakened, and the numbness of provincial darkness grows more chill and dead each year. It is against such a state of things that

we wish to raise up the Artist, among other powers, as a barrier and a protection. We wish to see, indeed, Art of all forms among us, and we do not underrate its effect even as a mere enjoyment; because all that is really Art, in whatever department of it, in some degree tends to refine and to civilize. But we do not hesitate to declare that something far higher too is necessary in Ireland; that here the pleasures of contented luxury are out of place; and that our dearest interest in the success of Art among us, in its encouragement to make a home among us, is that, among its many professors, some few, even some *one*, may arise, who shall from time to time pour out among us inspirations of a far higher character. The material circumstances of this country are now again showing signs of gradual but very substantial improvement. Let us endeavour to divert a portion of the superfluous wealth of those classes who possess any towards the encouragement of Artists born of our race and living on our soil; and if the form of an Art-Union, a machinery now well understood and popular enough, be found to answer such an end elsewhere, let us by all means adopt it in Ireland also, at least for a commencement.

The true encouragement of Art itself is somewhat different. In the free republics of ancient Greece, even in the midst of that general refinement and abundant private wealth in which the Painter, the Sculptor, and the Architect found ample sphere of action, the grander Works of Art, those of loftier aim and superior magnificence, were commissions from the state itself. It was thought that these were the noblest ornaments of the nation, and it was felt that the state was substantially served in thus stimulating the patriotic pride, while improving the refinement of its citizens. Among the Italian republics the same principles bore sway, and the encouragement to the Artist by such republican princes as the Medici was still national and popular; was felt to be so, for their palaces and gardens were open to the people almost as of right, and enjoyed by them as appurtenances of the nation, much as the royal palaces and gardens of France are to this day enjoyed by her entire population. The municipalities of modern Germany, Belgium, and France, each in its own sphere, have long been active in the same manner, and by public commissions to their greatest Artists have brought out all the power that was in them, in the illustration of the glories of their country and the celebration of the fame of her sons. In France the splendid halls of Versailles (now formally inscribed *A TOUTES LES GLOIRES DE LA FRANCE*) are devoted to the records of her greatness, expressed in magnificent paintings by the greatest living French Artists; and besides this the French nation purchases from time to time the most remarkable heroic and poetical works produced by the Artists in France, which are first placed in the public galleries of the Luxembourg, and when ten years have elapsed after the painter's death, transferred to their proper department in the great national collection of the Louvre.

Of such a nature is the true encouragement of native Art by a great Nation, and among the fruits of freedom one of the sweetest we look forward to is this. But the day is far off, and we must for the present use whatever means are allowed us by Fate. We Irish cannot look forward

to the decoration of a Parthenon, a Madeleine, or a Versailles, during the present generation; and yet it is not of less, but rather of greater importance, that we should provide the utmost possible encouragement to retain our Artists among us, and reward them to the utmost of our power, that they also may help forward the Nation in its destined way. Art-Unions supply a method of performing this duty; they can at least attract aspirants for artistic success. Intelligent public support should, however, crown all, ere the Artist fill the position he ought to fill in a civilized country; and this can only be looked for after the habit of frequenting galleries of good paintings, and the stimulus afforded by the annual distribution of pictures purchased through the means of an Art-Union, shall have gradually refined and elevated public taste, so as to enable it to comprehend the value of so chief a minister of civilization.

All Art-Unions, however, are not equally successful in attaining their end, either in encouraging the talent of the Artist, or in improving the taste of the public. Art-Unions are lotteries of Works of Art,* and their success as such depends upon the principle upon which the lottery is conducted and the mode in which, and the persons by or through whom, the money paid for tickets or shares is expended. Some Art-Unions divide their whole yearly income into a number of prizes, varying in amount, and the rights to these prizes having been distributed by lot among the subscribers, he who gains one is entitled to purchase any painting he pleases, paying for it, in the whole or in part, to the extent of his prize out of the funds of the society. This is generally called the Money Prize System. Other Art-Unions, through the instrumentality of a Committee of Selection, expend their yearly income in the purchase of a number of pictures, which pictures are then distributed by lot or raffle among the subscribers. This is generally called the Committee System. The former system has now almost every where prevailed, and those, who at first, some years ago, felt a preference for the latter over it, as being likely to secure the purchase of better works, because a selection in better taste, have been pretty generally undeceived by the practical ill working of selection committees. The London Art-Union, on the Continental system of Money Prizes, has been prodigiously successful, rather growing than decreasing in popularity, and yearly proving the advantages of such an institution in the encouragement to exertion of talented and promising artists. Our own, which was undertaken on the Committee System, though early established, hailed at first with universal acclamation, and for some years enjoying unbroken confidence in its selection committee, has signally and entirely failed, and has now become, and, we regret to say, deservedly become, practically extinct.

Both systems have their practical faults, and each has its advantages. The Committee System, in theory, presents the most attractive arguments

* Not long after one was established in England, they were discovered by astute Crown lawyers to be contrary to the laws against lotteries; but the influence of horse-hair gave way to that of public opinion, and Art-Unions (upon obtaining, however, a Royal Charter, *i.e.*, upon squandering certain £ s. d. upon certain bureau officials), have been legalised by the Acts 7 & 8 Vict., cap. 109; 8 & 9 Vict., cap. 57; and 9 & 10 Vict., cap. 48 (1846).

in its favour. It professes to repose in a select body of gentlemen, of high educational attainments, practised taste, and impartial judgment, the trust of purchasing with monies raised from the general public, such works as are really the best among those which may be exhibited for sale within the year. Such a trust, ably and faithfully performed, would seem best calculated to secure the fame and advancement of the Artists so crowned by competent judges, and at the same time to guarantee to each winner of a picture that he has obtained something worth preserving, and to secure the distribution throughout the country of true Works of Art, potent to refine and educate the taste of the general people. The committee become the autocrats of artistic taste, and the absolute governors of the whole body. And it happens to the Art-Union just as to the body politic: an absolutely perfect being, invested with absolute and supreme power, must necessarily secure the most perfect government to those beneath his rule; and there can be as little doubt that a committee *really* so qualified as above described, would be a most desirable ruling body to manage an Art-Union. But as in politics mankind has discovered by bitter experience that a just and good autocrat is practically unknown, and that absolute monarchy is practically an intolerable tyranny which performs well no duty of a government; so it has been found by the subscribers to Art-Unions that a committee at once fully competent and absolutely impartial, is a thing hopelessly unattainable, and that a committee not so gifted forms an intolerable management for the affairs of an Art-Union.

The late "Royal Irish Art-Union" affords a pregnant example of the way in which such institutions ought *not* to be managed. Abundance of money was subscribed year after year, and a certain portion of it was spent upon pictures, the majority of which were utterly unworthy of selection by any man of taste—mere trade pictures, in short, which the better educated members of the body were only too glad to *fail* to gain as prizes. And, by way of encouraging Irish Art (the special province of the institution), these trade pictures were generally those of obscure English painters, often the rejected of London Exhibition purchasers. The remainder (or at least so far as the public have had any account of the remainder) of the yearly income, was squandered upon tenth-rate prints, which may indeed be used by the thoughtless as wall furniture, but which a man who had any real respect for his home would not suffer to hang in his drawing-room. And even in these there was a yearly progress only from bad to worse. Beginning by putting in circulation a coarse, ill-rendered, ill-executed engraving of a very beautiful work by one of the ablest artists of Ireland, (who must surely in this, and in other instances, feel sorely the ill fortune he has suffered at the engraver's hands), the managers of this unhappy body descended at last to expend a large sum of money in the purchase of a cast-off plate, unsaleable in the London market, which produced an unworthy caricature of a noble Italian masterpiece; and they did this in defiance of the very conditions and principles of the undertaking which they were to carry on as trustees for the general body of subscribers. Of course when those subscribers found that what they got for their money

it would be much better to decline to receive, and that so far as the great object of affording encouragement to Irish Art, the committee had wholly broken the trust reposed in them, and this year after year,—of course, under these circumstances, the subscribers deserted the institution, and it has most deservedly ceased to exist. Were it not that the committee included several names of men the most estimable and the most justly respected in the city of Dublin, (pity that such men will so often good-naturedly lend their countenance to, and thus really undertake the responsibility attached to, acts which are not theirs,) the affairs of the late Art-Union would have probably ere now undergone a searching scrutiny, and its management have brought down the full weight of public indignation. Influenced by the same considerations, we also rest content with what we have said in general terms; but in dealing at all with this interesting subject, it would have been idle to pass over unnoticed what has been done in Dublin, and we could not honestly do less than point out the mischievous results which have before our eyes distinguished this example of the “Committee System” in the management of an Art-Union. This failure would for ever continue to act as a damper upon further exertions if the causes of it be not exposed, and these may be avoided entirely by the adoption of the alternative plan of action, a plan which has worked so well in other countries.

The true general principle then is that of the “Money Prize System,” because no opportunity is left to a governing committee to misdirect the application of the funds. Besides this there are other reasons: subscribers will feel greater interest in the society if the prize-holder has to exercise his judgment in selecting a work for purchase; the taste of the members will be gradually improved by that exercise, which it never could be under the other system, since he that will learn to swim must first go into the water; lastly, the great object of the association will be better carried out, and among other ways in this, that a greater amount of money will be expended on purchases, because he who obtains a prize of a certain amount, but desires a picture whose price is somewhat more, will often be disposed to pay the additional sum in order to secure it.* The London Art-Union occasionally also gives large premiums to the producer of any work of Art which appears to their council particularly worthy of such a distinction, and they likewise devote a portion of their funds to the production of engravings. Many of these are executed in a style by no means calculated to extend good taste in that department, yet it cannot be said that the money thus expended is recklessly thrown away, considering that so much is laid out in the purchase of paintings and sculpture.†

In Ireland, an Art-Union should mould its rules to the circumstances of the country, and as at present we have but few resident Artists, it would

* And in fact, during the last year, at the London Art-Union (1853), nearly £300 was spent in pictures by prize-holders, in addition to the amount of their prizes.

† In 1852 the amount subscribed to the Art-Union of London was £12,903 9s., of which £6,449 were spent in prizes, and £3,640 19s. 4d. on prints. In 1853, out of £13,348 13s., £8,001 were spent in prizes, and £2,548 8s. 1d. upon prints.

be unwise to limit prize-holders to selection from the works they alone exhibit. Our Exhibitions are open to all the world, and the Art-Union prize-holder should only be limited to purchase from works exhibited publicly in Dublin at the Academy, or any similar establishment, adding, as a provision against any collusion by which the prize-holder might convert a part of his prize into money, some such wise rule as that which obtains elsewhere, that no work should be selected the price of which shall not have been left or recorded at the first opening of the Exhibition in which it is exposed for sale. Prize-holders should also, however, be permitted to withhold the selection of their purchases at least until the Exhibition of the following year, in case they cannot satisfy themselves at once. The public would soon learn, if not from the very first, to select the best works, because each unpractised or uneducated eye would most naturally observe at least what others like, and few would purchase without consulting the judgment of those whose taste may be held in some repute.

But in Ireland something more is wanted to give an impetus and direction to Art in this nation, and we are persuaded that excellent results would follow the adoption of a prize system under which in every year a valuable prize should be offered beforehand for the best (or to be divided among the best) Works of Art illustrative of Irish national sentiment or history, and such a prize to be simply a premium or reward to the successful Artist, without accepting for it any return whatever. The judges should of course be the best obtainable in the country, and it is almost needless to insist that they should be few in number, so as to make them feel themselves really responsible, and that they should include at least *some* Artists of high professional attainments. The painter or sculptor, crowned by such a prize, would then gain a real distinction as well as a substantial reward, and would feel the former as the most powerful incentive to exertion in those higher paths of ideal creation, which are so little followed, because at present so little understood and rewarded by the public.

Upon the publication of engravings by Art-Unions, we should have much more to say if space permitted here any further investigation of details. Very beautiful Works of Art, in outline, in lithography, or rather engraving on stone, and even perhaps certain photographic reproductions of great Works of Art, might be prepared at a more moderate price than the pretentious and altogether worthless prints with which the public is at present deluged. We shall probably take another opportunity of inquiring into this subject, and shall therefore rest content for the present to offer only the few more general reflections which have been proposed above for public consideration.

A new Art-Union has been established this winter, which has before it the whole future upon which to try the experiment of a better regulated system than that which people have hitherto been accustomed to (and to suffer by) in Ireland. If the conductors of it recommence the course of their predecessors,* they will certainly reach only the same goal, and an-

* The proceedings of the new Art-Union, up to the present time, are not, it is understood, to govern its future plan of operations. The committee only made use of the objectionable "Committee System" because there was not time to

other such failure will do infinitely more mischief to Art in Ireland than a few years success can produce of advantage. The only way open to them towards the healthy life of such an institution is resolutely to change the system, and adopt that of money prizes. If some few of the public are disposed to place greater confidence in the taste of the committee than in their own, or if, living at a distance, they are unable to make their own selection, the committee of course may easily arrange to act for such subscribers, and even issue special tickets for such a purpose if required. But the general system, we are persuaded, must be that of money prizes, and upon that system we cannot but expect that the exertions of the new Art-Union, rightly directed, will produce great and lasting results. On another occasion we propose to inquire into the advantages of Art-Union premiums to Artists for success in the illustration of a particular class of subjects, as well as the subject of engravings distributed by such a body, a subject to which but little real consideration appears to have been given either by the public, or even by any of the committees of taste, so far as we have heard, in this country, and which is nevertheless entitled to great attention.

ART. II.—*On Domestic Economy, and particularly on that of the People of Ireland.*

LET us consider it as a settled fact, that Ireland desires to be Industrial: we say Ireland, for the success of the Manufacturing Industry of a country is not in the hands of any particular class of society; it would be a grave error to suppose this. Isolated manufactures may spread prosperity around them, may enrich some merchants, may supply the means of living to numbers of workmen, without affording a sensible relief to the community; for the riches of a country are the produce of the accumulation of all its strength, and of the development of all its intelligence. These productive forces consist of Agriculture, which increases and fertilizes that wealth which is the most indispensable; Manufacture, which transforms the original substance so as to suit our wants and tastes; and lastly, Commerce, which serves as a medium for the interchange of various productions.

allow of the working of the other, the Exhibitions being not only already open, but even about to close very shortly after the Art-Union was established. Hurdledly instituted as it was, many errors were committed, upon which, under the circumstances, we do not feel called on to remark. But its career, up to the first drawing of the prizes, proves two things: first, it adds an additional instance in illustration of what has been above advanced upon the inefficiency of committees in selecting good pictures, the promise of the prospectus having been by no means kept, "to purchase exclusively works of a high standard of merit;" and secondly, it shows what abundant support such an institution (even without an issue of bad prints) may still command in Ireland.

The cultivation of the soil being the fundamental element of national wealth, the well-being of the Agriculturist should be regarded as the surest index of the true prosperity of a country. Wherever the well-being of the Agriculturist is not sensibly felt to exist, there Manufacture languishes, or to speak more correctly, there is at bottom no manufacturing Industry. For how is it possible to speak of industrial prosperity when the earth does not afford sufficient food and support to him who cultivates it?

If the want and degradation of the agricultural population in Ireland may with justice be attributed to that legal system of prohibition which gives to a few the monopoly of the Soil, as in other countries a few privileged persons possess the monopoly of Commerce, we must confess also that the ignorance in which our agricultural population is plunged for so long a time, and their want of ideas upon all that concerns Domestic Economy, likewise exert a very great influence upon their unfortunate condition. Domestic Economy teaches us to make the best possible use of the little we may happen to possess. It increases, so to say, the resources which Providence has placed at our disposition. It teaches the Mother of the Family to prepare its food in a varied and agreeable manner, and leads her to utilize the time not employed in the work of the field. In fine, she becomes a source of profit to the community, in that she rears up habits of order, the first element of moral and social organization. We propose, then, in this article to trace the influence exerted over Industry by Domestic Economy in the article of Food.

It is only among civilized people, and under the influence of just laws, that we must seek those habits of order and forethought which are inspired by the security and the greed of possession. The savage thinks little of the morrow: if he finds food he devours it at once, without consulting whether he will be able on that morrow to procure it as easily. Even in the middle ages no year passed by but some part of Europe was desolated by famine. And how could it be otherwise, at a time when the greater part of the lands lay fallow, when the harvests were ravaged by soldiers, when the husbandman was forced to suffer every species of oppression and hardship. The living of the richer classes was simple and coarse: the mills produced but imperfectly ground meal; pig-meat was the usual food of the cities, and its immoderate use, joined to the filth occasioned by the accumulation of those animals, often produced the contagion of deadly disease. But we need not go so far back for examples.

How sad and striking a portrait Labruyère preserves to us of the French peasant under Louis XIV. A brute, rivalling the very swine in his food, and having nothing human but the form. And yet it cannot be denied that at this period the manufacture of luxuries in France had attained a high degree of excellence. At that very time, when the great King erected Versailles, rebuilt the Louvre and the Tuileries, whole provinces were devoured by famine. The evil had arrived to such a pitch, that it was even proposed to dispossess those who should let their lands lie fallow. This, it is true, did not prevent the poets from singing of the Great King, and flatterers from comparing him to the Sun. What ideas of Domestic Economy could the peasant of those days have had? uncertain of the

morrow, a slave bound to the soil, *tailable* and *corvéable* at will,* daily exposed to be despoiled of his gains by military requisition, compelled even to bake his very bread at the common oven of the lord, (infamous impost levied upon life itself,) his food was as coarse as his wants and his habits. What an influence too must not this wretched condition have exercised upon the industry of the towns. There also the artizan, hardly released from the feudal chain, found himself still oppressed by the rights of the Corporation, which levied an oppressive toll upon intelligence and labour.

The class of simple cultivators of the soil comprises two-thirds of the population of Europe: we ought to consider what influence the material prosperity and the economic habits of this class should exercise upon Industry. What a difference there is, for example, between the consumption of the agricultural citizen of the United States compared with that of the Russian Serf. It is chiefly for these masses of the agricultural population, hardly yet emancipated, that these cotton fabrics are manufactured, those stuffs so cheap, that pottery so conducive to cleanliness, and other similar articles, which makes the manufacturing wealth of England. "The products which the Earth supplies constitute the only inexhaustible riches, and all flourishes in a state in which Agriculture flourishes," said Sully, the minister of the only King whose memory the French People holds in honour. The men of independence and intelligence of all times have acknowledged these truths, and done their best to secure their general recognition. It was but with the eighteenth century that the true era of progress and emancipation began. Under the influence of the writers of this epoch, asserting rights till then misunderstood, and demanding justice for the husbandman, the *corvées*, the feudal fetters, disappeared, and the peasant saw himself again clothed in his natural rights. *To enjoy the fruit of his toil*: such is ever the primitive right of the labouring peasant. The right of possession came to raise up the dignity of the peasant; his living was bettered, and his ideas of Domestic Economy, better understood, began to perfect themselves. The progress made in roads and communications caused the products of agriculture to flow in abundance into the towns. The agriculturist endeavoured to satisfy the tastes of the consumer, and thus created for himself new resources. The system of practical gardening, introduced upon a large scale, while rendering life more easy, exercised on the other hand, a great influence upon the hygiene of the towns. Those foecal deposits which used to spread infection through the cities, are now a source of pecuniary profit, and Paris already draws from them a revenue of 533,750 francs.† These dirt-heaps are every day carried to one spot, where the farmers, after having sold their vegetables in the public markets, come to collect them for immediate use in manuring the ground.

The food of a people and its domestic economy generally, then, exert an important and permanent influence upon the condition of that people.

* Taxation imposts, the *taille* and the *corvée*.

† £21,350

The action of that influence is exhibited in various ways, but in none perhaps more distinctly than upon industry, a point which we shall now endeavour to establish. But we must here remind our readers, that it is only to the Domestic Economy and food of the labouring classes of our population that our remarks can apply.

The richer classes of society support life almost everywhere in much the same manner, or at least their food is based upon the same principles. They can supply themselves with the productions of different countries with greater facility even than the poorer inhabitants of the very regions from whence they obtain them; and if in general the food of the rich sins against the laws of hygiene, it is rather through excess than for want of those elements which are considered the indispensable constituents of wholesome food.

To be nutritious, alimentary substances should contain either the material elements of the human body, the chief of which are water, fibrine, albumen, and fat, or a series of analogous substances, capable by undergoing the metamorphoses of digestion, of producing them, such as sugar, starch, caseine, or the curd of milk, and the various mineral substances alike indispensable to the animal and vegetable organization.

With few exceptions, no single vegetable aliment contains all the elements necessary for the support of the human body. Some such, as beans, peas, and other seeds of the leguminous plants, contain a nitrogenous principle analogous to caseine, and are deficient in certain other elements, necessary for nutrition. Others again are very poor in nitrogenous substances, but are rich in amylaceous and saccharine substances, and saline constituents, which play an important part in the animal organism. Thus it is easy to see that a man fed exclusively on certain vegetables, would visibly decline, and might even perish in the midst of abundance of such food. Lastly, some vegetables, without possessing the nutritious qualities of meat, (qualities probably due to the organization of muscular flesh,) nevertheless contain all the substances necessary to the support of life. Such is, among the various kinds of grain, Wheat. It is not less true, that the exclusive use of Bread would end in effecting a fatal influence on the life of man, both physically and morally. Variety in food is an indispensable condition of health. Animals when fed for several months with one food, even though one of which they are especially fond, would end by letting themselves die of hunger and disgust. We might also instance particularly the injurious influence exercised upon prisoners, especially children, by the regime of certain prisons.

Judged by this standard, how imperfect is the diet of the Irish peasant. Even the two additional elements added by the action of the famine of 1848, bread and Indian corn, can, we fear, as yet be considered only as luxuries for a large mass of the people. Potatoes and buttermilk make up their customary nourishment, varied from time to time by a little fish; a pot to cook them, a few bowls, two or three plates, such is their entire service; and surely, no one could desire diet plainer or more frugal. This food may enable the peasant to vegetate, but not to live. It contains, it is true, almost absolutely all the substances necessary for life, but is neither

sufficiently varied, nor sufficiently solid. This system of living must exercise a fatal influence on his condition. It is a necessary cause of demoralization in driving him to seek in factitious stimulants, such as tobacco and whiskey, the satisfaction which he cannot find in his food. It makes the woman lose that high influence, that moral authority which she ought to obtain in the family circle. The mother of the family not having learned to take a better part in what surrounds her, all is squandered without return. Order and cleanliness disappear from the house, and self-respect at last is lost, the most powerful enemy of baseness and beggary. Finally, pity is sought for instead of respect, and they end in becoming consumers, without being producers. Such a mode of life must tend to arrest all agricultural progress, and to spread disorganization far and wide.

The picture which we have just given of the condition of the Irish peasant, is not in the slightest degree overdrawn; but is that of the labourer or the poorer artisans of the town much better? no, and it could not be otherwise, for the total disorganization of everything connected with the domestic economy of the peasants, must inevitably extend to the towns. The dwellings of the poor in the latter, may perhaps, in some respects, be better than the mud cabins of the peasants. But when we recollect how much our physical well-being, and perhaps to some extent our moral also, is influenced by the circumstances in which we are placed, we must admit that the narrow and filthy streets of which our corporations seem to ignore the existence—the ruined houses, crowded with a teeming population from garret to cellar—the pits of manure reeking with contagion, are not conditions favourable to that well-being. And we are sure all will admit that a good system of diet, or a proper economy of living, need not be sought for there. At this moment, the hard-working artisans of Dublin, to take this city as our example, may be said to live upon bread and tea or coffee; the better paid have perhaps an occasional meat dinner, and yet, taken as a body, they are not comparatively worse paid than in other countries. The cause of this state of things is simply, that the whole economical organization of the food, the lodging, and the clothing of the working classes is radically bad. Certainly, no better proof could be offered of this fact, than that those productions of the country, which ought to form the staple food of the people, are exchanged for the dried leaves of an exotic plant. Tea is no doubt an agreeable and civilizing beverage, but cannot be considered as food—it is a luxury; and until the artisan is first able to eat a solid dinner, we must look upon it as a misfortune, that the use of tea has become so general. In many parts of England, and in the United States, the importation of tea is a true index of the prosperity of the people, because they exchange for it their superfluous products or manufactures; but in Ireland it is simply an index of the social disorganization of the working classes, because we exchange, not our superabundance, but our necessities of life.

We have numerous societies in Ireland, each of which takes some interest of the country under its special protection; one of them offers prizes for apoplectic cattle, verdant fields of turnips, thorough draining,

and all sorts of improvements in the ventilation and improvement of stables and cattle-stalls; but we have not heard that it has offered a prize for a well-stocked cottage-garden, for the encouragement of cleanliness and comfort in the homes of the workmen. And yet, if the general agriculture of a country is to be improved, the reformation must begin there.

It is always useful to contrast the condition of our own country with that of some other more prosperous. With this object we shall select France, not because the peasant is all that he should be there, but because the principles of domestic economy for the poor are perhaps better understood there, than anywhere else with which we are acquainted. There is another reason also why we select it, because we may thereby learn how rapidly a country may recover from the most complete state of social disorganization. We have already showed what the condition of the French peasant was, even during part of the splendid reign of Louis XIV., a state but very little improved under his immediate successor. It was not, indeed, until the Revolution of 1789, that the whole system of agriculture of France was changed, by covering the soil with small *proprieters*. The system of division and garden cultivation in most parts of the country, forcibly replaced the ancient systems. The feudal imposts having vanished, and the peasant finding himself no longer despoiled of his crops by the agent of the revenue, the taxes being no longer collected in kind, had every interest in forcing the soil to yield its utmost. The only obstacle still remaining is the relative ignorance of the husbandman. Public instruction was seriously organized in France only in 1831.

The position of the French peasant has, however, nothing in it to be envied. It is only by incessant toil that he attains to being able to rear up his family honorably; he is attached to the soil, nothing can tear him from it—he loves the land, he hankers after it, and all his efforts tend to enrich his field—his style of life is of the soberest, but is varied—he gains something from all that surrounds him, and in this he is aided by all the efforts of the family, and by those of his wife in particular, who assists him in such of his labours as are the least toilsome, not like a servant, but as a devoted companion of his life.

From the great extent of France, there exist considerable climatal differences between different parts, and consequently a similar variation in the productions of the soil. With each climatal change comes one in the food also; while the maize, the olive, and the vine contribute to the support of the inhabitants of the parts bordering the Mediterranean and the Pyrenees, the old Normandy and Bretagne scarcely differ in productions from Ireland. We are not therefore going to recommend a system of French cookery for the use of the Irish labourer; every country must develop a system for itself in consonance with its climate. But where domestic economy is properly understood, the principles upon which the preparation of food are there founded are equally applicable to every part of the world; and the most important of those principles is simply to profit by the use of the greatest number of vegetables and other alimentary substances possible, to combine them together in such a way as to obtain

the wholesomest food at the smallest cost. In Ireland, at this moment, the labourer and even the artizan do not employ in their ordinary daily food more than five or six alimentary substances—in many cases, indeed, but two or three—nay, how often have we seen a family compelled for whole weeks together to live upon a single vegetable, the potatoe. If we count up the total number of vegetable and animal substances, exotic as well as native grown, employed, no matter in how small quantities, by nearly six millions of the Irish people, during the course of a year, it will scarcely amount to *twenty-four*. The French peasant, on the other hand, employs during the same period perhaps between sixty and seventy! The application of capital to the soil, in the shape of newly-invented machines, may undoubtedly be but little advanced in those countries, when compared with some parts of Ireland, but the striking fact which we have just mentioned shows that man himself is there the primary object, as he is with us the secondary.

The French peasant turns to profit nearly all the families of edible plants; the soup, with which he can scarcely dispense at all his meals, consists of vegetables, beans, peas, or other leguminous seeds, boiled either with a small quantity of meat, or even with some rich substance. Bread constitutes a very large part of the soup, and is also largely consumed with the solid aliments of a meal, no matter of what kind. Bearing in mind this truth, that variety is an indispensable condition of wholesome food, it is easy to understand how much this system of nutrition is preferable to that of our rural population. The potatoe is doubtless a wholesome and useful aliment, but it should only constitute an accessory to a meal, and not the chief or sole element. The great fault committed in its use was to habituate the people to believe that it could *take the place of every other aliment* in their food. We now know what the acceptance of this error for so long a period has cost us. Besides, the exclusive culture of only a few vegetables, the result to a great extent of the organisation of the land, tends to arrest all agricultural improvement; whilst, on the other hand, it causes the people to degenerate.

The necessity of providing for this great variety in their food is a wonderful stimulus to the industry and intelligence of the peasant. The mere fact of cultivating or collecting some thirty or forty vegetables, compels them to work harder than he who cultivates but one or two, whilst at the same time it teaches him to utilize everything around. Hence it is that in France and Germany so many small industries are connected with agriculture, whilst, with the great deterioration which has taken place in the food of the Irish peasant during the present century, and his complete social disorganization, all household industries have vanished.

The abundance of leguminous and other vegetables in the neighbourhood of towns contributes very much to facilitate the means of living of that part of the population which is able to consume but very little meat, whilst it enables the middle classes to enjoy an agreeable variety in their dinners. So little is this kitchen-garden culture developed in the environs of our towns, that, with the exception of a few of the commoner vegetables, the meat element of a dinner is really cheaper than the

vegetable. This is remarkably the case in Dublin, where the deficiency of a cheap and varied supply of vegetables, the organisation of the markets, &c., render it possible only for the rich to live comfortably, and has driven the poor to adopt the system of diet which we have already so strongly deplored.

The culture of leguminous plants and of certain kinds of grain in France, has come as it were to supply the want of butchers' meat, by rendering the fattening of poultry very easy. Geese, ducks, hens, and rabbits, are the objects, in almost every part of that country, of a considerable trade, and a source of great profit to the peasant. Every one knows to what a degree of perfection the feeding of poultry has been there carried, but many of our readers will learn with surprise the development and skill to which rabbit feeding is arrived, when we tell them that some varieties of that animal weigh, when fattened, from 10lbs. to 15lbs. This special branch of industry is the duty of the children, which, while it gives them useful occupation, trains them to habits of industry and thrift, and at the same time supplies the family with an excellent article of food.

The territorial division of France into 38,000 communes, each having its mayor and its council, has, it must be confessed, aided to propagate this system of domestic economy, by grouping together the inhabitants of the same commune. A market established once or twice a week, according to the importance of the commune, gives to the peasant the means of disposing of his produce. In these markets may be found at the same time all the products of the soil and of the household industries of the peasants. This is not the place to speak of these rustic industries, to which reference has been already made; but we hope, on another occasion, to make our readers acquainted with their nature and influence upon the comforts of the Continental peasant.

The revolution, which gave to the French peasant the power to possess a part of the soil, has not, as it is pretended by some persons, tended to ruin agriculture; on the contrary, a new element of vitality has been created, for, with the elevation of the dignity of the peasant, his notions of domestic economy have been developed. The value of land has also greatly increased, and many parts of France, hitherto considered irredeemably barren, now bear fruitful harvests.

It will undoubtedly be the same in Ireland when the peasant can realise on his native soil the same advantages which he finds to day in the forests of America.

JOURNAL OF SOCIAL PROGRESS.

ART. I.—*On Partnership en Commandite.*—(SECOND ARTICLE).*

PARTNERSHIP with limited liability being, as we showed in our former article, established, we may say, in every country of the civilized world, except Great Britain and Ireland, and uniformly with success, and containing in itself a principle of the utmost importance for encouraging and stimulating industrial enterprise, let us ask, what imaginable objection can be made to its introduction into English law?

The objections (apart from the weighty one of being new and “alien to British ways and habits”) may be divided into three:—

First, it is said that it is essentially unjust in principle that, if a partnership fails, the suffering parties should be the creditors and not the partners; that a man should trade and obtain profits, and throw his losses upon other and innocent persons; so said Mr. Hawes before Mr. Slaney’s committee of 1851; so said others before the committees of 1850 and 1844. We reply, that there is no injustice whatever. It is, and would be, unjust, fraudulent, and criminal, to induce a man to advance money or goods upon the faith of the existence of capital, when there is none, or of solvency when the concern is insolvent, and such holding out of *false security* must be guarded against in every system, as it must exist in every system while man is man. But in what respect it is unjust that a creditor who makes his advance upon the specific and avowed security of the unlimited liability of certain parties, and of the limited and defined liability of certain other parties, should have exactly the security which was held out to him, and no more, requires keen casuistry to discover. If there were anything in the objection, it would smash the whole principle upon which every railway and other chartered or statutable joint-stock company is based. But it has been always, we believe, considered very just, that a bargain should be a bargain.

But not only is there no injustice to creditors, but there is the very reverse even of hardship. For how does the case stand at present? Credit is given to a concern either at hazard, taking the bad with the good, and running chance; or else upon the faith of some floating and indefinite public opinion as to capital and solvency, which opinion is as often wrong as right. Well; the concern we will say fails. What then is discovered? That it started originally upon *borrowed* capital, borrowed perhaps from a money-lender at a high rate of interest, or from a friend

* See ante, No. 1, *Journal of Social Progress*, page 12.

who was anxious and willing to give his friends a start in life. And what follows? This earlier creditor swamps the others, abstracts the greater portion of the assets on a distribution in bankruptcy, or very likely has taken the precaution of enabling himself to sweep them away entirely under a bill of sale. Now, suppose the firm to have been started, not with borrowed capital, but with capital obtained *en commandite*, then the person who advanced it changes from a conflicting or overriding creditor into a *contributory*. The other creditors, so far from having him to contend with, have his engaged subscription to cut into, and are, of course, far better off than they would be if the capital was borrowed. When the introduction of the *commandite* system was mooted many years ago, objectors said, "repeal the usury laws," (then in force,) "give facilities for borrowing money for commercial or other enterprises, and you obtain all the advantages you look for." John Mill gave the above answer, and it is unanswerable.

But it is urged, that in point of fact credit would be given, not merely to the managing partners, but to the whole concern, and chiefly on account of the *commandite* partners, and that if the latter should be men notoriously wealthy, their names would induce persons to trust the firm, without consideration of the fact of their liability being limited. To which we answer, that men who will follow a blind imagination rather than clear public statements, are such as no laws on earth could protect. If I choose to act upon the assumption, that John Thompson's whole fortune will be a security to me, when the written engagement stares me in the face, that he is only bound to the extent of £500, it would be very idle indeed of the community to refrain for my sake from passing laws otherwise beneficial; for if I did not ruin myself in one way, I would in another.

Secondly, it is said, that the system would lead to innumerable frauds, and, amongst others, that men would engage to subscribe beyond their means, and so induce a faith in a false capital. That the *commandite* system would be made the occasion of fraud, we not only do not deny, but would undertake to affirm upon oath if necessary. And we will abandon the whole case upon being referred to one human law, code, constitution, or arrangement whatever, in which human roguery may not find its account. That the system would specially or peculiarly lead to fraud, we entirely deny, and we beg to say, that not one tittle of evidence or sustainable argument has been given to show that it would. It has been in operation for centuries on the Continent of Europe, and there is an overwhelming concurrence of testimony to its admirable working, without any allegation that it has been found specially to lead to fraud. And the very nature of the system, its cautious, definite principle—forming, as it has been everywhere found to do, an allurements for prudent, thrifty men to embark in it—is a guarantee that it will not only be not more, but far less, the occasion of fraud than the system of common partnership. England, which has hitherto rejected the *commandite* system, has not her fellow or her second in the world for enormous mercantile frauds, while France and other Continental countries are comparatively free from them. And with respect to the instance of men engaging to subscribe beyond their means, it is quite possible, but is,

as an objection, a mere chimera. Remember this: the great peculiarity of the practical working of the *commandite* system consists in the mutual confidence reposed by the *commanditaires* and active partners in one another; the confidence of the former in the talent and skill of the latter, the confidence of the latter in the solvency and funds of the former. And this it is which makes *commandite* partnerships generally so local in their character, formed of men who know one another, and differing widely from the joint-stock bubbles, which seek their subscribers and victims over the face of the earth. Now, premising that we may fairly suppose that the very large majority of trades and businesses of all kinds are entered into with the *bonâ fide* intention of carrying them on in the usual way, and making money of them, we ask, is it not highly probable that the active partners, in common care of their own interests, would seek an assistance which would be a reality and not a sham? And with respect to the supposition of a concern which would be a swindle from the beginning, that is to say, *commanditaires* of straw choosing managers of straw, and getting credit under false pretences, we do not see one whit more chance of success such a concern would have, than any partnership got up by men of straw at present. The limiting of the liability of a pauper would hardly increase his credit in the market; and as a writer in the *Westminster Review* well observes, "such an objection, at least, comes ill from the advocates of unlimited liability, for supposing every *commanditaire* in a firm not to be worth the sum he put down his name for, the creditors, at least, can take *all* he is worth, and so practically enforce unlimited liability so far as he is concerned."

The last objection is one that regards England alone, and we refer to it because it is a negative which, as regards this country, is pregnant with a very conclusive affirmative. It is, that capital is so abundant and accessible that it needs no encouragement or stimulus to direct it into all proper industrial channels. But to do the opponents of the system justice, there does not appear to be one of them who would not be willing to admit its benefits in a country circumstanced like Ireland. Appended to Mr. Bellenden Ker's report on the subject are papers from Mr. Tooke, Mr. Larpent, and Mr. Jones Loyd, in which the case, as against the *commandite* system, is put forward with much ability and care. It will be seen that, thinking the system not needed in a country flush of capital like England, they all concede, or at least will not discuss the question, as applicable to countries *where encouragement to capital is wanted*.

Mr. Tooke says—

"The object of the proposed introduction of the law of *commandite* is stated to be that of encouraging the bringing of real capital into private trade. Here it may be asked at the outset, is such encouragement wanting? In France, which is often cited as an example of the favourable working of the system, *the spirit of commercial enterprise being comparatively languid*, the security thus held out against more than a strictly limited loss might be necessary to induce persons possessed of capital to venture any part of it in trade. But in this country, where commercial enterprise appears to be on the full stretch in every branch of industry, and where an abundance, I should almost say an exuberance, of capital presents itself as being ready to embark in any enterprise that holds out a specious

prospect of gains, the example of France does not apply. *No encouragement seems here wanting to bring capital into trade.*"*

And Mr. Jones Loyd,

"The abundance of capital and active spirit of enterprise and commercial emulation which exist in England, are found to be practically sufficient to secure the prosecution of every undertaking of reasonable promise, even under the restraint which the present state of the law is supposed to place upon the spirit of commercial adventure. In other countries, where *either capital is less abundant*, as in the United States, *or where the spirit of commercial enterprise is either more feeble or less generally prevalent*, as in Continental countries of Europe, the case may be different."†

And Mr. Larpet—

"The question is, how far a limited responsibility may be admitted into English partnerships. *If in this country the capitalist were indisposed to run the risk of partnerships, and commerce and manufactures were in consequence crippled for want of capital, then it might be desirable perhaps, by lessening the risk, to encourage such investment of capital*; but this is notoriously contrary to the fact: no ordinary trade or manufacture is left unprosecuted, where profit is possible, for want of capital, and it is the accumulation of profits beyond these ordinary demands, that raises the public funds, and leads the capitalist to invest in companies or extended partnerships."

Now, in Ireland every one of the conditions exists which, in the opinion of these gentlemen, might render their judgment on the introduction of the law of partnership a very different one. Here capital is small, scattered, languid, and timid; here, if anywhere, enterprise requires the spur rather than the rein; and so true is this, that Mr. Bellenden Ker,‡ who, after long consideration, seems finally adverse to the adoption of the *commandite* principle in England, declares that it is "quite shocking that no one will take up the subject as regards Ireland." The utility and expediency of its adoption here is, then, a matter upon which there is really no difference of opinion whatsoever.

The Irish Act to which we referred in our first article,§ fully recognizes the principle of *commandite*, the economic reason of which is set out clearly and forcibly in the preamble:

"Whereas the increasing the stock of money employed in trade or manufactures must greatly promote the commerce and prosperity of this kingdom, and many persons might be induced to subscribe sums of money to men well qualified for trade, not of competent fortune, to carry it on largely, if they were allowed to abide by the profit or loss of trade for the same, and were not to be deemed traders on that account or subject to any further or other demands than the sums subscribed."

Recognizing indeed the principle, but then, in the true spirit of legis-

* Appendix to Report on Joint Stock Companies, Parliamentary Papers for the year 1844, vol. vii. p. 269.

† Ibid, p. 273.

‡ In our former article, Mr. Ker's report of 1837 is stated as decidedly favourable to the *commandite* system. This is an inaccuracy. In fact, the report is a very able summary of the arguments on both sides, but the author refrains from expressing any opinion.

§ 21 & 22 Geo. III. c. 46.

lation after the British model, so much afraid of letting the principle have fair play, so hampering it by limitations and restrictions, checks, precautions, complication of machinery and arrangement, that it is no wonder indeed that it has not worked.

The first section limits the partnerships to be formed under it to wholesale trade and manufacture, excluding agricultural, draining, mining, and fishery companies, and in fact nearly all the class of works which under the *commandite* system have been so lucratively worked in Holland and Belgium; and again, the last section excludes banking companies and all companies for retail dealing, the fact being that many of the most prosperous and useful *commandite* companies abroad are retail concerns.

The second and third sections provide that the subscribers are to nominate acting partners (equivalent to the French *gerans*) in whose names, with the addition of "and company," the business is to be carried on, and that the remaining subscribers whose names should not be mentioned in the firm, should be called anonymous partners, and that the partnership should not be liable to their debts, or they to the debts of the partnership, further than is after provided.

The Act then goes on to provide that each anonymous partner should immediately pay one-fourth of the sum subscribed by him, and the remaining three-fourths within a twelvemonth at farthest, on pain of forfeiture of the sum already paid for the benefit of the partnership, and of being liable for the remaining three-fourths in case of failure of the concern.

An account must be made once a year of all the effects and debts of the co-partnership, and a balance struck and signed by the acting partner and at least two-thirds of the anonymous partners. This provision is an excellent and necessary one, but the clause which follows is one which, it seems to us, must, more than anything else, have tended to render the Act nugatory. It enacts that after such settlement of accounts, each partner may take out of the partnership *half of his share of such profits as may have arisen*, the other half, together with monies forfeited under the preceding provisions, to go towards the increase of the joint stock until the expiration of the partnership. This of course was meant for the protection of creditors, but it is quite idle to think that men in general will invest money upon the terms of half the yearly income of that money being locked up from them for an indefinite period. The seventh section, which is the substantive clause, limiting the liability, declares that each anonymous partner who should have executed the partnership deed, and paid his full subscription, and who should not have infringed the provisions of the Act, should not be subject to the bankrupt laws, nor liable to the partnership debts for more than his subscription *and the profits received thereon*; and that in case of dissolution of the partnership before the time of payment of the three-fourths, he should be only liable for such three-fourths.

The liability to refund profits is the very point which we mentioned as having been so much mooted under the French law. No doubt, it also was introduced for the sake of creditors, but we must own we do not think that it is a provision called for in reason or justice. The true

way to consider the position of the anonymous or *commanditaire* partners is, as Mr. Ludlow has very well put it in his evidence before Mr. Slaney's committee of 1851, by considering him not so much in the light of a partner according to our ordinary notions, as in the light of a peculiar species of creditor. He does not carry on, or aid in carrying on the business. By every *commandite* law in the world, the *commanditaire* is excluded from the least control, interference, or voice in the affairs of the partnership, on pain of losing his privilege. The most ruinous speculation may be embarked in under his eyes without his having the power of putting out a finger to stop it. His position is that of one who advances money upon the terms of taking, instead of fixed interest, a fluctuating dividend, running chance for its being high or low, or none at all, and also running chance for his principal. The creditors have the advantage of having their security increased by the amount of his principal, but we cannot see that there is any justice whatever in forcing the *commanditaire*, in addition to the positive loss of his capital, to refund what had formed his income in bygone years.

The Irish Act goes on to make the shares of anonymous partners assignable, if the deed of partnership shall so provide, but not otherwise, unless with the consent of all the other partners; and even after such transfer, the original partner, unless he have paid the whole of his subscription, shall remain liable for it until the partner accepted in his stead shall have fulfilled his engagement. This provision is, in our opinion, perfectly fair and unobjectionable.

The clause providing for registration is also quite just, and with some few changes in detail, such as we would recommend at this day. Before the time fixed for the commencement of the partnership, or within ten days after, the partnership deed, or a memorial thereof, must be registered in the registry office, and the memorial must contain the date of the deed, the names and descriptions of the parties, distinguishing which of them are active and which anonymous, the sums agreed to be paid by each, the time of the commencement and duration of the partnership; and the memorial must be under the hand and seal of the acting partner or partners, attested by two witnesses, one of whom must have witnessed the execution of the deed by all the parties, and the payment of one-fourth of the subscribed capital.

The changes in detail as to registration, which we would recommend, are these: in the first place, a copy of the deed should be required to be lodged in every instance, and it should be the duty of a public officer to enter in a book kept for the purpose, and carefully indexed, an analysis of every such deed, setting out briefly its substantial provisions, with all the particulars as to names, qualities, and amount of sums subscribed, which are required by the Act. And there should be an office in every county, in which a transcript should be kept of such analysis of the deed of every partnership under the Act, having a place of business within the county. Lastly, every publicity should be given to the formation of such partnerships, by rendering necessary the publication of proper newspaper advertisements of their formation.

There are, then, clauses rendering imperative the disclosure of any debts existing between the active and anonymous partners at the time of the formation of the partnership, on pain of rendering them null and void, but validating all subsequent dealings and transactions between them; and also rendering any anonymous partner guilty of fraud, or contravening the provisions of the Act, liable to the bankrupt laws, and enforcing regularity of books and accounts on the part of the active partners, on penalty of certain forfeitures.

The amendments we would be inclined to make, in order to render this Act an efficient and practicable one, would be made chiefly with a pair of scissors. The radical fault of legislation here is its cumbrousness, not merely in language but in substance—its attempting to provide too much. The very elements of scientific legislation appear to be unknown to our legislators. What a mass of Acts appear on the statute book, in which it would appear that the framer was industriously striving to foresee every mode in which his statute could be abused or evaded, and to introduce some ingenious provision or another by way of preventive. So the Act becomes an incongruous, unmanageable machine, the use of which is destroyed by over anxiety to guard against the abuse. Now this method is in our judgment radically wrong. You cannot—it is hopeless—you cannot foresee every mode in which bad men may pervert your beneficial legislation to an evil purpose. But what you can do is this: lay down succinctly and intelligibly the provisions intended to direct and assist the honest and *bonâ fide* working of your measure, visit all perversion of these for purposes of fraud with heavy penalties; and as to what particular things shall constitute such fraud, do not attempt to specify or define them; leave that to the judgment of twelve intelligent men who will understand better than any lawyer what is the *bonâ fide* working of a system, and what is its fraudulent abuse. What an example the French code is in this respect. With what briefness, clearness, and intelligibility everything is expressed, and how admirably it is found to work. And this arises not more from the proverbial genius of the French for *netteté* of thought and expression, than from their much more philosophical and scientific conception of the province of legislation.

We would then, in dealing with the Irish Act, propose simply to repeal all the restrictive provisions as to the nature of the business, amount of capital, and duration of the partnership, so as to allow a *commandite* partnership to be entered into in any business, for any time, and with any capital the partners thought proper. We would repeal the clause requiring immediate payment of one-fourth of the subscribed capital, and leave all provisions as to amount or time of payment, to be settled by the partnership deed. We would also entirely repeal the clause preventing the anonymous partners from drawing more than half their profits; and with these omissions, with the changes as to registration and publication which we have recommended, and a provision similar to that in the French and New York codes, preventing the *commanditaire* from taking any part in the active management of the concern, we think the Irish Act would work effectively and beneficially.

ART. II.—*On Public Libraries, and particularly on the Means of Establishing a Public Library in Dublin.*

It is scarcely open to argument, that in every country where a considerable number of the inhabitants know how to read, public libraries will continue to be a necessity at least until immense improvements in printing, and a complete revolution in the publishing trade, shall have brought the more valuable productions of literature and science, yearly evolved from the press, within the reach of the poorer and working classes of the community. It may be confessed that in this country the necessity becomes more and more urgent, where so very large a proportion of the whole population have now for so many years had the advantage at least of learning their letters in tolerable schools, and whose people have always exhibited so great a greed for learning, and for learning of any kind, however inappropriate, which they may find accessible to them. And when we blame our fellow-countrymen, as we are now and then very apt to do, for the want of so many of the habits, ideas, and enjoyments of refined civilization, (so vividly perceptible on returning home from France, or almost any other part of the Continent), let it be remembered for a moment that we are not only shut out, politically as well as physically, from the direct influence of Continental ideas, but even ignorant of the practical value of books, the indirect next best means of educated progress. There is little solid education among any class we are acquainted with in Ireland, and among the less opulent, and of course among artizans and those poorer still, almost none whatever. We may reasonably attribute much at least of this to the want of public libraries in Ireland worthy of the name; and as this subject, although one of universal interest, seems to occupy no part of the public attention at the present moment, we have thought it right, shortly but emphatically, to introduce it thus early for consideration.

We shall not now present any detailed account of the great system of public libraries enjoyed by the people of France, Belgium, several of the German States, and the United States of America, nor shall we describe the details of arrangement, or record the statistics of the many noble institutions of this kind, which might be singled out for example in each of those countries, and again from Sweden in the north to Spain in the south of Europe. We shall postpone as well to another occasion any remarks upon University and other public libraries in England and Scotland, and upon the few establishments in Ireland bearing the same name. For the present our only object is to show that much may be done in every city and considerable town towards supplying the want we have alluded to, and that without incurring any very considerable expense, and without necessitating any very great support from subscriptions, at least in the first instance. It is our persuasion that energy and means in abundance are available for the purpose, and that so many failures as we know to have occurred in the management of institutions which might have filled the place of the public libraries of the Continent, have arisen only from the incapacity or carelessness of local committees, who seem to be generally

unacquainted with the wants of those whose support a library committee ought mainly to seek, and regardless of most of the necessary conditions of useful and successful management. Those who are acquainted with Dublin will readily be able to apply these remarks, and to those who are not, the deficiencies which we only desire to correct may serve as examples by way of warning to other places.

As to every civilized state the moral and intellectual as well as the physical well-being of its inhabitants is of the highest importance, and that even in a material point of view; so in every civilized state the education of the masses of the people has deservedly enjoyed the attention of the legislative authorities, and in most countries it is deemed a proper expenditure of even a large share of the general taxation to support some general system of national education. Precisely the same arguments which apply in favour of the application of large sums out of the national income to national education of the primary sort, will be found to apply with equal force, in each municipal district, in favour of the application of some portion of the municipal revenues to the establishment and support of good public libraries, which are to so great an extent the schools of the adolescent and adult population of the cities and greater towns. If the municipalities were alive to their real duty, and the municipal councils or governing bodies were disposed to perform their real duty towards those whom they govern—their local state or charge—no such city or town would be without its public library, established and supported altogether at the expense of the district, and freely open as of right to every person residing within it. The principles here indicated have been asserted with success even in the English Parliament, and were in substance affirmed by Wyse's Act, 8 & 9 Vict. cap. 43, and their execution still more clearly provided for by the Act 13 & 14 Vict. cap. lxxv. (14th Aug., 1850), passed in substitution for that statute. Municipal corporations are now empowered to found and support such institutions; but in Ireland (we believe) no municipality has as yet availed itself of the power. Perhaps the idea of a complete public library conveyed the impression of an undertaking too extensive and too expensive not to alarm the limited municipal mind; and if corporations cannot be persuaded to go in advance of their constituents, and lead them onward in the way of civilization, instead of so generally standing in the way of it as they do, it may at least be possible to push them a few steps in the right direction, trusting to the influence of more extended education itself, and the thirst it inspires for more and still more, to produce eventually civilized local administrations. Let us in few words describe a middle course, at least as an offering for the leisurely consideration of our fellow-citizens.

A library even tolerably complete, supplied not only with the standard literature of various countries, but with new books according as they appear, would no doubt require a very large original outlay, and very considerable annual sums for its support; but something very far short of this would be abundantly sufficient for the main purpose of a public library for the mass of the population. It is well known that the general or public reading-rooms attached to the great libraries of Paris and London (the

Bibliothèque Nationale, and that of the British Museum), are supplied only with the principal books of reference, and standard works of general resort in the department of the arts and sciences, history and the classics. The visitor who requires to consult publications of a special nature, or of less importance, obtains the work demanded from the attendants, without being admitted to the great miscellaneous library; but in the reading-room he can refer to the classes of books just referred to without making any special application. These consist of Dictionaries and Grammars of all languages, Cyclopædias, the best editions of the Greek and Latin Classics, and of the principal classic authors in the various Modern Languages, the general treatises on the Arts and Sciences (and these should include the French, which are almost invariably the best written), the best works on Ancient and Modern History, the best Maps and Topographical works, the principal Travels and Voyages, the chief general Law books, such as Codes, Commentaries, &c., the Public Reports and Parliamentary Documents, and the Transactions of the learned Societies and Academies both native and foreign. Such a collection, with the addition perhaps of some few other volumes, and especially in the French language, the knowledge of which it is of so much importance to encourage, would comprise the greater part of that which the general public (including all classes) ought to have access to as means and matter of indispensable education; and it should include the principal books more immediately bearing on each trade and occupation of life, in which the working man might find materials and suggestions for his his practical improvement in his vocation. The lighter works, such as novels, plays, most light literature, periodicals, and pamphlets, as well as the greater portion of contemporary publications, the reader may be permitted to seek in one of those institutions where access to them may be secured at a small rate of subscription. But the advantages of the more solid library above described *ought* to be afforded at the expense of the community to every individual within its pale; and such a library—collected somewhat gradually, prudently, with proper judgment in the selection—would not require any considerable initial outlay (a very good beginning could be made for about £2000) and could be kept up at a very trifling expense.

Under the act last referred to,* the borough may erect and keep up

* 13 & 14 Vict. c. 65, § 1, gives power to the mayor, upon the request of the town-council of any municipal borough, whose population exceeds 10,000, to ascertain whether the Act shall be adopted in that borough, by public notices and advertisements, calling on the burgesses to express their opinion by votes for or against its adoption. § 2 provides for the regulation of the voting by persons entitled to vote. § 3 enacts that only those whose names are on the burgess roll shall be so entitled, and that the adoption or non-adoption of the Act shall be determined by their votes, two-thirds of the votes given being required for its adoption; in case the Act shall be adopted by the borough, the town-council is empowered to purchase or take on rent "any lands or buildings for the purpose of forming public libraries or museums of art and science, or both, and to erect, alter, and extend any buildings for such purpose, and to maintain and keep the same in good repair;" and for that purpose, and to pay the principal and interest of any monies borrowed under the Act, to levy with and as part of the borough rate, or as separate borough rate, the necessary sums, provided that the sums so levied shall not

the necessary buildings; and as a borough rate of even a *farthing* in the pound should produce about £500 a-year in Dublin, the construction of a suitable building (even if it were necessary to erect one), as well as the maintenance of a library with a complete staff of attendants, may be secured at any time without causing even a perceptible increase in the taxation of the city. It remains only to obtain the nucleus of a collection of books, and to secure its progressive development—the act not giving any power to expend taxes in this manner—and that, it appears to us, may be also accomplished with much less difficulty than is commonly imagined.

Such a selection of books as that before described, including, as it does, only those which must be considered *necessary* for the community, omits almost the whole range of attractive light literature, the essays, travels, political, historical, and scientific works of the day, and all reviews, magazines, and literary periodicals; in fact, all that class of publications generally sought after from month to month, and for the opportunity of reading which most people are very willing to pay something. Nothing can be more reasonable than to make this section of a well selected public library pay for itself; and it appears to us that it might be enabled to do even more: at least to supply the few necessary additions to the other or free department, especially where the latter supports a staff which would be quite sufficient for both branches.

It is not enough to afford the artisan, occupied as he is throughout all the day, the opportunity of reading in a public library. He requires for himself and for his family something more. He should have access to a good *Lending Library*, from which, at a very moderate rate of subscription, he may bring to his own home, for the innocent amusement as well as the instruction of his wife, his sons, and his daughters, as well as himself, such publications as will enlarge his mind and theirs, and supply at least a portion of the education of which the middling classes are so generally in want. The literary food of those classes is unfortunately at present too much of the lowest description, and the libraries of the Mechanics' Institutes show an increasing tendency towards what is worthless, or worse, inundated as we are with cheap publications, generally empty, if not absolutely injurious. And yet there can be little doubt that if means or opportunity were allowed him, the artisan would often gladly seek and diligently make use of books of a really high order. We have heard mentioned one instance of the desire of knowledge among these classes,

in any one year exceed one halfpenny in the pound on the annual value of property in the borough. § 4 empowers the town-council, and any committee appointed by them (whether members of the council or not), to purchase and provide fuel, lighting, fixtures, and furniture, and to appoint and salary attendants, and to make rules. § 5 gives power to borrow, with consent of the Treasury, on security of rates under the Act. § 6 vests all property of such institutions in the town-council. § 7 enacts that admission shall be free of all charge. § 8 ordains that, in case of vote being adverse to the adoption of the Act, the burgesses shall not be called on to decide on it again for at least two years. § 9 saves museums already undertaken. §§ 10 & 11 reserve power of amendment, and entitle the Act the "Public Libraries Act, 1850."

remarkable enough to be preserved, and which may serve as an illustration of the necessity of attention to what it is really the duty of the municipality to provide for its population. A poor but intelligent artizan was employed some time ago to do some work in the shop of an eminent bookseller in this city. During an idle half hour, while waiting for orders, he chanced on Johnston's "Physical Atlas," then lately published, which was lying on one of the tables—a work now well known as one of extraordinary value, and whose great price (ten guineas) of course put it totally beyond the reach of a poor carpenter. But so diligently did he use his time, and so well was he able to appreciate the importance of the publication, that when his employer returned, he had already resolved to make an effort at least to compass the possession of it. He ascertained its price, and after making his calculations in his own mind, he proposed to be permitted to pay 3s. 6d. a week until the price should be completed, if the bookseller (who knew him well) would lay the book aside for him till then. It is needless to add that that gentleman at once acceded to his request, and with true liberality permitted the carpenter to take home his treasure that very day.

In France and Belgium, in the United States, in almost every part of Germany, most public libraries are also wholly, or in part, lending libraries. In Denmark even the University Library of Copenhagen (of 150,000 volumes) is a lending library. In Sweden the same principle is recognised as the leading feature of such an institution. In England and Scotland it is creeping also into recognition. In all these places the general experience of the system is favourable to it, and every where it is reported that no loss, or a loss nearly nominal, is the result. In Dublin we only know of one good lending library—that of the Dublin Society—and there the loans are confined necessarily to members only. In Cork, the Cork Library (to which the subscription is £1 a-year, and where there are above 800 subscribers) is a large and flourishing reading and lending library, and to its existence upon this plan is deservedly attributed much of the well known superiority of Cork over most other places in literary and general education.

In Dublin then we ought to have a free public library, consisting of what are ordinarily called "library works," into which every person of good character, whatever his means or station, should have free admission to read both by day and in the evening. We should also have a public lending library, at the smallest possible rate of subscription. This department could be carried on well at an expense not exceeding £500 a-year over and above the expenses of the necessary staff; and the latter expenses would be reduced to nought if the lending library were associated with a free reading library, supported at the public expense under the Public Libraries Act. The subscription therefore might very well be fixed so low as *ten shillings* per annum, at least for those classes to whom such an establishment would be of the greatest importance. The wealthier, and those who would subscribe rather for amusement, as a luxury, than for a higher motive, might be charged at the rate of £1 a-year, so as to interfere as little as possible with the ordinary circulating libraries, which be-

sides by their conditions as well as their contents would continue largely to supply the idle classes of the community. It would be matter for arrangement by the library committee under what circumstances and subject to what restrictions (as deposit, security, greater or less length of time for each loan, &c.), books should be lent out; and there is abundant experience upon all these points. Suffice it here to say, that all the details are not only practicable, but easily so: all that is necessary to the success of such a library would be found to be a good beginning, supposing that, in a population of 350,000 of all classes, about 1000 or 1200 supporters might be counted on, and we may surely assume so much. A good beginning, however, must include the original establishment of a well-selected library of moderate dimensions in both departments.* Much would of course be done towards this by donations of books in the first instance. It may be calculated—we need not here go through a process of suppositions—that, in addition to these donations, a good *nucleus* of works in both departments might be secured at a cost not exceeding about £3000; for any private individual could form an admirable library in the course of a year for much less money. This sum would have to be raised then in the first instance, and the interest upon it would not be much less than £150 a-year. A sinking fund, to the amount of at least £100 a-year, should be set apart to reduce the principal; and if we diminish as yet, until the debt be paid off, the amount to be yearly expended in books to £350, we shall have an income of £600 a-year only required to secure to Dublin an adequate nucleus of a public library, whose usefulness and value would yearly increase in rapid progression, and of whose good effects upon the most valuable portion of our population it would be difficult to form any just estimate.

We shall not on this occasion dilate on those effects, nor on the various uses which might be made of such an institution, and which we are convinced would be made of it, by all classes of our working fellow-citizens. Not the literary man alone, but the humble shopkeeper and the hard-working artizan, would find in it comfort and improvement, and his family would be sure to bear its profitable fruits to a new generation. The library is as necessary in our times as the school or the college, and a public library in Dublin would be the true INDUSTRIAL INSTITUTE, of which our working population is in need. [*See Note, next page.*]

In thus addressing ourselves to the wants of Dublin, we have not been neglectful of those of other cities, nor even of much smaller towns. Any example brings home the truth to the mind more powerfully than a volume of general essays. Let our remarks be applied by each reader, with such evident modifications as shall occur to him, to the necessities and the capacity of his own locality. Even the smallest town may have its little library, just as the poorest man may who makes anything beyond what his absolute wants require. And how very much may not each

* It would of course be best to avail ourselves of any existing collections capable of furnishing a nucleus, and there are some such in Dublin. There is even one establishment which, with ordinary good management, might effect the greater part of what we require; but we have thought it best to deal with the subject as if the undertaking were to be commenced altogether *de novo*.

educated individual add to his knowledge and his taste by the judicious expenditure of but a very few pounds in the year! It should be our desire to extend in every way the number of readers of wholesome and valuable works, and if we may not in a little locality open a thousand volumes to its inhabitants, we may perhaps secure at least five hundred, and if not five hundred, then let us seek to establish a nucleus of one hundred, be they but really the cream of ten times the number. No one can guess what may be one day the fruit of the seed sown by any one of them.

[NOTE.—During the last two months there has been a great deal of discussion upon the proper application of a considerable sum of money most worthily subscribed to mark the recognition of WILLIAM DARGAN by his fellow-countrymen by some enduring memorial, and the committee to whom those subscriptions were intrusted have resolved to devote them to the erection (chiefly) of a suitable building for a National Gallery. No better or more worthy object could have been chosen; but the committee appear to have annexed to it the idea of a Museum of Industry, or of Art applied to Industry as well. This idea cannot be made to harmonize with that of a great collection of works of high Art, and for this, as well as for another reason, it will have in the end to be abandoned. That other reason is conclusive: that such a museum already exists in the Government Establishment in St. Stephen's Green, which is secured abundant support from the general resources of the State. If, however, in constructing a noble building for a National Gallery, its Hall were erected over another story, devoted to a free Public Library, such a union would hurt no principle of taste, and the greatest public want of Dublin would be supplied to those very classes whom it is Mr. Dargan's honour that he ever so sedulously exerts himself to elevate and improve. Little would be thus added to the cost of the whole building, and £1000 of the subscriptions devoted to the nucleus of a library collection (that above described as proper for a free library) would be speedily supplied by the many additional subscriptions so useful a design would be sure to attract from all quarters.]

ART. III.—NOTICES OF BOOKS. *Museums, Libraries, and Picture Galleries, public and private; their Establishment, Formation, Arrangement, and Architectural Construction, to which is appended the "Public Libraries Act, 1850," and remarks, &c.; with Illustrations.* By JOHN W. PAPWORTH, F.R.I.B.A., and WYATT PAPWORTH. London, Chapman & Hall, 1853.

IN the previous article allusion has been made to the existing facilities afforded by law to the construction of Public Museums, Libraries, and Galleries of Art, and the general scope and contents of the Act of 1850 have been noted (*ante*, p. 42.) The volume now before us is designed by the writers to be a practical commentary on the Act, and the Messrs. Papworth, architects of experience, (we shall not stop to criticize their own works or seek here to measure their particular claims to professional reputation), have endeavoured to explain the necessary preliminaries to the establishment of the public collections proposed to be encouraged, thinking it "a duty, perhaps a profitable duty, to lay before the public some account of the matters chiefly necessary for consideration, in so far as regards the establishment, formation, security, accommodation, and conduct of such

institutions." We shall take the authors at their word when they describe the motives which suggested the publication, but we must add, that their promise is fairly carried out, and that this volume does contain the suggestion of most of what is really proper for consideration on the part of those interested (as we hope all our readers are) in the establishment of such public institutions here and elsewhere. The style of the work is a good deal stilted and pretentious; the writers are so much disposed to the dogmatism of didactic teachers who have mixed but little with the world, that here and there we cannot repress a smile; but the book is on the whole a highly suggestive and really a valuable contribution to popular knowledge on the subject of these buildings, and it certainly contains enough of valuable matter, well arranged and clearly developed, to earn for it instant recognition by all committees and promoters of projected Museums, Libraries, Picture Galleries, and Athenæums in this kingdom. When we remember the characteristic ignorance and almost invariable incompetence of most such committees, we cannot help thinking that (*faute de mieux* at least,) the unimaginative dogmatism of two practical men, who are evidently very much in earnest, and certainly possessed of knowledge by no means generally diffused among us, must be productive of excellent results, and we can honestly recommend Messrs. Papworth's work to the immediate and attentive consideration of all those who are or are likely to be engaged in such useful undertakings as those we have alluded to.

The volume opens with the Act of Parliament, to which praise much too unqualified has been given, for it is a cumbrous substitution for Wyse's Act, (which it repeals), and its intention is marred, as in most English Acts of Parliament, by restrictive forms suggested by the same restless spirit of *doctrinaire* over-legislation which has made English law in general so unwieldy and inefficient. After the text of the Act we have chapters on LIBRARIES, (their site, arrangement of books, admission of the public, accommodation, and preservation of the collection,)—PICTURE GALLERIES, (their site, sizes of pictures, number of rooms, arrangements, accommodation, and preservation), and MUSEUMS, (treated in the same manner). In these chapters are arranged a great number of suggestions, with all of which our opinions may not, it is true, exactly coincide, but which are all well worthy of serious consideration, and the discussion of which will be sure to lead to many important practical advantages otherwise likely to be lost sight of. Lastly, (and this is the cream of the publication,) we find a very suggestive sketch of the elementary architectural arrangements necessary, and even of many of the ornamental developments, appropriate to each class of institution; and this portion of the work is illustrated by a number of fine plates, among which we have (besides detailed original plans for provincial Museums and Libraries) sections and plans of the great Library of Sainte G  n  vi  re, at Paris, the Museum of Natural History, at the Jardin des Plantes, (Paris,) the Picture Gallery of the Academy of Arts at Venice, and the celebrated PINACOTHEK, at Munich, (generally considered the most successful picture gallery in the world,) as well as the gallery at Clapham, near London, designed by the writers' father, the late Mr. J. B. Papworth, so much approved by Sir C. Barry, and by Sir C. Eastlake, the President of the English Academy.

The importance of a judicious architectural design for a gallery of pictures or sculpture, it is needless to say, can scarcely be overrated, and the ridiculous failures which have generally attended the attempts of English architects to suit such buildings to the objects of them, (failures arising, it is to be presumed, from the general ignorance of the said English architects upon the subject of what is and is not a good apartment for the exhibition of works of art,) ought to afford a caution for the future to thoughtless committees who are so apt to borrow from whatever is "in fashion" in a neighbouring country, or to take on trust the capacity of some architect who has acquired a reputation among people at least as ignorant as the said committees themselves. We do not know what may be the powers of the Messrs. Papworth in working out what they describe, because we have not seen any of their handiwork, (and we certainly shall take nothing on trust); but in the volume before us, they have addressed themselves with much clearness and force to the investigation in detail of the elements necessary to success, and as they have avoided the display of unintelligible technicalities, their observations will be found extremely interesting as well as useful.

On the whole, we are glad to be able to recommend this volume to those interested in this important subject, and we hope that at least no public society, book club, or mechanics' institute, will neglect to provide itself with so valuable a publication.

We have not space to make such extracts as we should wish, but the following short description of the most remarkable modern picture gallery is suggestive as well as interesting:—

"The number of lineal feet of wall in the great picture galleries is as follows:—Munich, 1,600; the Louvre, 1,300; Berlin, 1,116; London, 670; and Dresden, which as much exceeds the extent of Munich or Berlin, as these do that of London.

"The celebrated architect, the Baron Von Klenze, describes the Pinacothek at Munich, as being destined to receive all those objects of Art which are not in Relief, such as Paintings, Drawings, Engravings, Enamels, painted Glass, Mosaics, &c. The first floor contains the pictures, the ground floor receives the other works. The paintings are grouped according to schools, (perhaps more perfectly effected than at Berlin,) and a corridor runs the whole length [420 feet] of the building, which communicates with each separate room, so as to arrive at any particular school without going through another. The large pictures are in very large rooms lighted from above; the smaller ones are placed in lesser rooms, with a side light from the north. The principal rooms for pictures are 42 feet wide, 31 feet 6 inches to the top of the cornice, and 52 feet high to the opening of the lantern. The leading features of this gallery are the staircase, entrance saloon, and a room devoted to the exhibition of new acquisitions. [The good effect of this apartment in receiving a crowd, which only goes to satisfy a momentary curiosity, is obvious]. There are also a curator's room, and his backstairs, and reception room, or perhaps (also) copying room. The ancient Flemish school has one large and three small rooms, [off it]. The ancient German has one large and four small rooms, [off it]. The more recent Flemish school has three large and ten small rooms. There are one large and three small rooms for the French and Spanish schools; and three large rooms, one of which is 93 feet long, with three small rooms, for the Italian pictures. Then, there are subordinate rooms for the purposes of the gallery. The ground floor is devoted to a gallery for engravings, and another for original drawings; there are also spaces for terra cotta vases and mosaics; and the other rooms contain glass, porcelain, enamels, &c. * * *

JOURNAL OF SOCIAL PROGRESS.

ART. I.—BANKING. *Banking in Ireland.* No. I.

As we entertain some views on banking not quite in accordance with certain popular theories on the subject, before entering upon a review of the condition of Ireland in connexion with its banking institutions, we consider it important to lay down some general principles, in relation to which we regard all banks and banking operations here and elsewhere. We maintain—

First,—The establishment of a bank is not a creation of capital, but an application of it.

Second,—The power of a bank's operations is not a new force, but the result of powers otherwise existent, but probably waste in whole or in part.

Third,—The maximum power of a bank is the sum of its capital, and the sum of the surplus pecuniary capital of its customers, lodged in the bank, either as deposit, or afforded it by the process of accepting the notes of the bank in lieu of actual money.

We do not assume that these propositions are likely to be called in question by those who really examine the principles therein laid down, and which we have endeavoured to lay before our readers in their least controversial forms.

That certain subsequent operations of a bank come to resemble the actual creation of capital so closely as to deceive ordinary observers, we readily admit, but still it is only a *resemblance*, as the following example will illustrate:—

A.B. wants £100. We may suppose A.B. a gentleman of large income, but suddenly requiring £100, or thereabouts, to expend in anticipation of his rents. He enters the office of his nearest banker; he passes his bill for £100; he receives £99 in lieu thereof, the same being placed to his credit by the banker, or handed him in the banker's notes. All this time the banker has in reality parted with nothing, except, perhaps, a few notes of no intrinsic value, yet he has deducted £1 from the amount of the customer's bill for his discount. The casual observer asks, What is this but a creation of money? The banker gets £1 for the circulation of a few intrinsically valueless pieces of paper. Granted the banker has got what will be ultimately equivalent to him to £100, and he has parted with his notes for £99 only; but in all this, as the customer leaves the counter with the notes in his pocket, there is no creation of capital, the case merely stands thus—the customer owes the banker £100, payable in two months, and the banker owes the customer £99, payable on demand; the banker may be looked upon as £1 richer than he was ten minutes before, but the customer is £1 poorer on that view of the question; so still there is no creation of capital.

If we advance a stage further, and assume that the customer buys a horse for £50 and wine for £49, with the bankers intrinsically valueless notes. Is not this a creation of capital from nothing? Most assuredly not. The man who has parted with his horse has merely changed places with the buyer; he becomes creditor to the banker for £50, on his notes which he has taken, and the same is the case with the wine merchant. Let us proceed another stage: granted the horse seller continues creditor to the banker for some time longer; but the wine merchant, what is his course of business? he deals in an article imported from abroad, he has to pay £40 for this wine himself in Cadiz, and he enters his banker's office (the same banker, if you please), and he directs him to pay Garvey & Co., of Cadiz, £40 for the wine in question. They do not take our bankers' notes in Cadiz, so by one or other process he must send some forty sovereigns to Messrs. Garvey; and what probably occurs is, that before the customer's bill has become due, which is to replace the £99 advanced by the banker, the banker has in some shape or way paid gold for the entire £99; but even if he has not, the case is not altered so as to effect our proposition, for he remains debtor for £99, and the holders of his notes are so far capitalists, who trust the banker to owe them so much; and the extent to which they can trust him in this way will depend on the extent of *their* pecuniary capital. Therefore, to return to our third proposition, the maximum power of a bank, that is to say, its greatest power of making advances, will be the sum of the banker's own capital, and the sum of the surplus pecuniary means of his customers, directly lodged with him, or indirectly afforded him by holding his notes in place of demanding their payment in actual money; in this sense it is to be observed, that every one holding his notes is termed a customer.

We have premised all this, because we desire that our readers should not believe that we mean to hold up any special system of banking as the source of wealth.

According to the habits of the people amongst whom banks are established, they may become either a help to industry or a facility to improvidence; of themselves they will create nothing, but they can act as the vehicles whereby the existing surplus capital of certain members of society may be temporarily conveyed to the hands of the industrious, who *by labour* will augment the wealth of society; or to the hands of the prodigal, who will scatter what labour has already created.

Let us instance a case of the augmentation of the wealth of society by the hands of industry, and through the intervention of the banking system. The illustration will not be the more defective because we descend for it to an humble class.

By the side of "the Galties" a peasant farmer has a small holding, just enabling him to pay his rent and to live. There are stronger men, and perhaps weaker men, in the banking sense, living adjacent. It is his lot to bear a good character, to hold an improvable piece of land, to have a hardy frame, and three or four stout children; he applies to a neighbour or two of known substance, and he tells them that if he were now placed in the actual possession of £20, he sees his way to double it within a very

short time; his friends believe him, join him, and £20 is raised at costs of a few shillings and stamp duty. Before night he has bought two store pigs, some wool for his daughters to spin, a calf, some seeds of crops which he has seen to succeed on a neighbour's farm; but not one shilling of the money raised has gone into consumption, or has as yet enabled him to eat a better dinner than if his good neighbours had never helped him to raise the money.

Next, the wheel is busy; the offal of the humble homestead is economised, that the store pigs may become fat pigs; there is food enough for the second calf—he had one before; the sons, grateful for their neighbours' kindly treatment of their father, put in the new oats and some mangold wurzel, and, full of hope, set to work at their little farm; and they succeed—the £20 has grown into £30 or £40 before the harvest is well over; the banker is paid, the rent is paid, and there is £10 to £15 in hand—beyond any sum known for many a year in that house.

Next spring there is an expansion of their minds and of their efforts: they may again require £20 or £30, for their operations are increasing, and a bit of waste land has been drained by the boys; but they are better *marks* than before, and the ever-kindly neighbours will join them again—and they will avail themselves of the aid with better knowledge and increased energy—what need of detail? This honest peasant farmer is the type of what we desire to illustrate, whether you expand the idea to that of the extensive grazier, or, entering the towns, select the trader to exemplify the principle.

We shall now educe a short general rule, applicable to all banking advances:

In order that a banker's advance should be beneficial to society (for instance, such as the State should encourage), it should be made to enable the party accommodated to carry out some fruitful industry.

And deducible from the foregoing, it will be found that, in the same ratio as the advances of bankers in the aggregate follow or depart from this rule, so will the sum of their powers to advance be increased or diminished.

Thus, a banker who, locating himself in a certain district, follows the rule, will enrich the district, and increase the pecuniary funds of persons lodging their money with him, and so his powers to increase his advances expand.

Bankers call advances with the industrial basis legitimate advances.

We trust it will be obvious to our readers that, apart from the question of the *safety* of an advance, which is the *primary* consideration with the banker, society (the State) has a direct interest that his advances should be of a legitimate character.

Let us have an instance of an advance not based on any industrial application of the funds raised.

An annuitant of £100 a year has, from his own recklessness or spendthrift habits, or from an over-easy nature, got himself in debt £50, and left himself without cash in hand; in this state of his affairs, he obtains the security of a solvent friend, and raises £100 from a banker. His other debts are forthwith paid, and he has £50 cash. What application does he make of the money on hand? He has no use for money but to

spend it. He has no land to cultivate, no store cattle to feed fat, no wool to spin. He *spends* the money, and when the bill which he has passed to the banker falls due, it has probably to be taken up by his solvent friend.

Let us then, for example, see how society stands, what addition or diminution of capital the operations we have described have produced. This is the result: the banker's capital or profit is increased, £1 10s. we shall say, by the transaction, the debt being paid; but the total of the capital of the annuitant borrower and his solvent friend are diminished by £50, or precisely the amount of his *excessive* expenditure consequent on the facility with which he obtained accommodation. Some portion of the £50 thus consumed, however, it may be alleged, still remains in society, being the profits of tradespeople with whom the spendthrift annuitant has dealt. This is, doubtless, theoretically true; but the amount thus saved to society is comparatively small, as these profits are scarcely more than sufficient to maintain the traders engaged in purveying to the spendthrift annuitant.

For instance, suppose the trader who has supplied him 50 barrels of oats for his horse has made 50s. profit thereon, this is a very small sum in comparison to the value of the 50 barrels of oats which have been consumed in the support of an unprofitable horse, maintained on borrowed money.

Having thus laid down, although in a rudimentary and homely way, the principles which we conceive constitute the vitality of the Banking System, as bearing on the industrial employment of capital: we must reserve for another article a review of certain laws—Acts of Parliament—affecting banking in this country, some of which need amendment; but in the meantime, we by no means desire to convey that, according to the present conditions of trade and agriculture, in proportion to the present demands of *skilled* enterprise, that there is any actual deficiency of banking capital in Ireland. Nay, further, we feel quite assured there is a redundancy of money means applicable to the development of all projects properly sustainable by banking institutions. What is most needed is the combination of those qualities of skill and thrift, which, not *in the banks*, but *in the customers*, constitute the essential difference between banking in Scotland and in Ireland.

The joint-stock banks of Ireland possess a paid-up capital to the amount, of £5,000,000; a statutable power to circulate their promissory notes, payable to bearer on demand, of above £6,000,000; a further amount of capital which may be called up, if the circumstances of the banks render it *profitable* to extend their operations, of £5,000,000; and deposits to the probable amount of £10,000,000 to £12,000,000. We are of opinion then, that with some slight modifications in the law, without any infraction of the principles of Sir Robert Peel's Banking Bill (the 8 & 9 Vict., cap. 37), for some time, the existing banking means of this country will be found quite equal to the legitimate expansion of her fruitful operations.

We cannot close this article without expressing our full appreciation of the recent proposition of the Chancellor of the Exchequer, to effect, by an

alteration of the law, an adjustment of the scale of stamp duties on bills of exchange and promissory notes, so as to relieve the negotiators of small bills from the present severe and unequal pressure of the stamp tax. We have little doubt that, even as a direct fiscal measure, Mr. Gladstone's new scale of duties will prove abundantly successful. It will not be out of place, however, that we should call attention to an anomaly in the stamp duties, also deserving of immediate legislation, which fortunately requires but small space to specify.

We refer the reader to Sir Robert Peel's Irish Banking Act, the 8th & 9th Vict., cap. 37, sec. 14, which enacts—"That from and after the 6th day of December, 1845, it shall not be lawful for any banker in Ireland to have in circulation, upon the average of a period of four weeks, to be ascertained as hereinafter mentioned, a greater amount of notes than the amount composed of the sums certified by the Commissioners of Stamps and Taxes as aforesaid; and the monthly average amount of gold and silver coin held by the banker during the same period of four weeks, to be ascertained in manner hereinafter mentioned."

We do not object to one letter in the section of the Act just quoted. We should say, let it stand by all means; but we contend that there should have been added thereto some provision to the following effect:—

Provided, however, that in the payment of composition in lieu of stamp duty on the amount of notes in circulation, by bankers issuing notes after the passing of this Act, no banker shall be liable to pay composition duty on a greater circulation than the amount to be certified as aforesaid by the Commissioners; that is, the banker shall not have to pay a composition duty on the amount of notes issued against gold to be held at the depots as provided for in case of the banker exceeding the certified circulation.

We should extend our observations beyond our present limits by adducing arguments to prove the propriety of introducing now a special enactment on this head. We believe, however, that, to a financier of Mr. Gladstone's acute reasoning powers, little is necessary to be done beyond drawing his attention to the fact, that the circulation of this country *on the metallic basis* is obstructed by a law which taxes the banker 7s. per cent. per annum, for the circulation of notes *issued against an equivalent amount of specie* held at the depots prescribed by the 8 & 9 Vict., cap. 57.

We shall just add one or two further observations. The law at present renders it imperative on bankers issuing notes in Ireland to make them payable at the place of issue. This should cease to be the law in respect to notes issued against gold held at depots. Such notes should be *issuable* anywhere within the realm, if *payable at the depot*, otherwise a banker, *quoad the particular excess*, will in all probability have to issue his notes payable in a different place from that at which he has to deposit the *specie* against which such notes are circulated.

Particularly at a political juncture such as the present, with war impending, it is vastly for the interests of the State that its surplus capital should be retained, and wrought into the internal industry of the country; but we could easily prove that, maintaining a composition duty or tax upon the notes which a banker circulates on the metallic basis, and the

rendering it compulsory on him to make his notes payable where issued, whilst he has to keep pound for pound in specie against these notes at another place, is to afford capital a direct premium in favour of its exportation.

ART. II.—*On the Management of Public Galleries of Painting and Sculpture.*

THE Proceedings of the English Parliament for the past year, among the annual accumulations of "Blue Book" literature, in which the Collective Wisdom tracks its slow course along, include, at least, one volume upon a subject of general interest, from out whose enormous mass some items of information may be gleaned, and some lessons may be extracted. We mean the Report of the Select Committee of the House of Commons upon the management of the English National Gallery, and generally upon the best mode of preserving, augmenting, and exhibiting to the public the public collections of antiquities and fine arts—extending, with its appendices, to 1,015 pages, blue book folio. Having conscientiously perused the entire volume, it appears to us sufficiently noticeable at the present moment to claim some reference here, because we are, at last, likely to form the nucleus in Ireland also of a National Gallery, and the facts elicited by this Committee, and now recorded in this huge tome, should be attended to from the very commencement of such an undertaking. Indeed so startling are they, that wherever works of art exist and are valued, either in private or public collections, either in large numbers or in small, it would be well to secure a copy of this report, and the evidence attached to it, so as to make its contents as accessible and as widely known as possible. The volume costs but 12s. 6d. (15s. by post), and has an extensive and very complete Alphabetical Index to the entire of it, including the Evidence and the various Appendices.

The report is weak and inconclusive. The Select Committee appear to have desired to express no opinion at all, or, at least, to express as little as possible, and they have certainly passed over *very* lightly an amount of incompetence, carelessness, and utter want of business habits on the part of the managing trustees of the *English* National Gallery, ever since its first formation, the extent of which they could not help reporting, and which will surely be felt as one of the most astounding examples of the way things are managed in a country whose chief boast is of her business-like regularity that laughing Europe has been favoured with for a considerable time.

The National Gallery of England owed its commencement to the parliamentary purchase of Mr. Angerstein's collection, in London, about thirty years ago. On the 2nd July, 1824, a Committee of gentlemen, afterwards known as Trustees, was appointed by the then Prime Minister, to manage the gallery for the Treasury, and it has been "managed" ever since by that committee, vacancies on it by death being filled up by the Govern-

ment for the time being, and additional members appointed now and then by the same authority. The present Committee consists of the First Lord of the Treasury and the Chancellor of the Exchequer, *ex officio*, and fourteen other members. The President of the English Royal Academy has always been one, and the Committee includes, and has included, not only some of the chief collectors in England, (as: the late Sir G. Beaumont, Lord Lansdowne, the Duke of Sutherland, Lord Ellesmere, &c.,) but also ministers, ex-ministers, and men of "practical experience" and "business-like habits" enough (such as the late Sir R. Peel, the late Earl Grey, Lord Monteagle, Lord Ashburton, Sir James Graham, Lord Overstone, and Mr. Thomas Baring),—a committee, in short, of able artists, able ministers, able practical men, and several of the chief collectors in England, whose private galleries of art are among the finest in Europe. To such a committee of trustees was committed, and such a committee *conscientiously* undertook, the management of an English "National" collection, and (under the orders of the Treasury, which, of course, obtained the necessary funds by Parliamentary votes) the selection and negotiation of purchases. And so admirably was the "National trust" managed by such a respectable board, that it took the Select Committee several days of questioning applied to keepers, cleaners, officers employed by the trustees, and the trustees themselves, to ascertain the mode in which their business was conducted, or rather to ascertain (what surely no one could have guessed *a priori*) that it was not done at all.

The present keeper, Mr. Uwins, (an "Academician" too,—save the mark!), alluded to the "Regulations" according to which the board acted, and the minutes of the board likewise referred to them,—Treasury regulations, it was supposed; and Mr. Uwins used them by way of excuse for himself, for he disclaimed all responsibility on account of picture-cleaning, &c., which did not attach to *him* under the "Regulations." And so the committee searched for them up and down, but none such appeared on the Minute Book, and after several other witnesses had failed to point them out, Sir Charles Eastlake, the last keeper, but now P.R.A., and one of the trustees, stated that the "Regulations" were only "minutes and resolutions of the trustees . . . erroneously called Regulations" (Question 4,411); that "for *regulations* the term *usage* should have been employed," and that he, Sir C. Eastlake, "believed there were *no* Regulations." (4,408). Finally, Lord Monteagle, a trustee since 1835, puts an end to all doubt, and with respect to the management of the gallery, the duties and responsibilities of the inferior officers, and even the mere care of the pictures, and the direction and supervision of their "cleaning" (by which so many of them have been irreparably injured), the ex-minister, the man who made himself a peer by his talents as a "man of business," he, an old trustee who attended to the trust, and before that had officially attended to the arrangements connected with the gallery as a minister—Lord Monteagle says:—"There are no written general regulations at all, nor were there when I undertook the duties in 1835. I have no reason to believe that there ever had been; for at that period we had members of the board who had been original trustees, and I never heard from any of them that the

Treasury had furnished them with any general regulations, or that they framed any for their own government, or submitted them to the Treasury for approval or adoption." (4,966.) And his business-like lordship further informs the committee (4,967-8-9, &c.) that the "Trustees" of the gallery are not, and never have been, a corporate body at all, and were originally called a "Committee," and how or where, or why they came to be, or to be called "Trustees" he could not tell!

The "National" Gallery of England then was so begun, and so carried on, and valuable pictures were bought at large prices, and many of them were varnished and cleaned, and many of them injured and spoiled (there is a terrible list of them in an appendix to the report), apparently by no one's legal order, at no one's risk, and on no one's responsibility. The Academicians (exquisite specimens of the *Artist* they appear to be on this report), keepers of the gallery, were believed by the trustees (Lord Montague at Q. 4,987, Mr. W. Russell at Q. 4,805, and others in other places) to be their professional advisers; and present at the meetings of the unregulated board, they were supposed by silence, and often too by words, to consent to and approve of the proceedings. But the Academicians deny that they had any thing to do with them: they had received no instructions, had no responsibility in the matter, and true lovers of art as they were, it was not their business to interfere where even the most priceless gem was condemned to spoliation. And how can either trustee or keeper be made responsible? Mr. W. Russell "had no instructions, written or verbal, upon the subject of his power or duties," as *Trustee* (Q. 4,784), "considered his responsibility to be exceedingly undefined," referred to the "law officers of the crown" for a definition of it, (1) for "inasmuch as there is no instrument expressly creating or defining the trust, it appears to be so vague, that I should be sorry to take upon myself to define what the responsibilities are." (5,785) And Sir C. Eastlake declared that he had no specific instructions on his appointment, as *Keeper*. (4,391, &c.) Begun then without a plan, carried on by an irresponsible unpaid committee, and "kept" by irresponsible paid officers; pictures bought by "artists," who cared so little about Art, that they would see a noble work ruined under their own care without remonstrance; pictures cleaned by "fashionable" dealers, whose trade and whole occupation it is to prey on the priceless works of genius—the wonder is, not that this gallery is so inadequate a collection for educational purposes, and so limited in extent, and so injudiciously filled even to that extent, as it is on all hands (save the officials) admitted to be, but that it is at all a good collection, that it does at all contain so many works actually among the finest in the world. Alas for the genius that has been lavished on these, that an evil fate should have permitted Mr. Angerstein to bring to *England* the glorious collection he had formed, instead of directing it to a country where such works of art might obtain the affectionate care which without enthusiastic recognition works of art never do or can receive in the world.

We do not intend to offer any suggestions as to the course which should be taken by the English to preserve, or to increase their gallery. Of course they will take *some* course, and probably immolate some inferior official,

according to custom, in consequence of this Blue Book having brought to light the scandalous incompetence and mismanagement of *all* parties connected with the trust, from the Cabinet Minister and the President of the Academy down to the picture-cleaners' assistants, with their buckets of warm water. Of course, also, a people so rich as the English are (and are likely to continue to be, collectively, for another generation, at all events) can easily extend their collection largely every year, and amongst many pictures imposed upon them, can probably secure, from time to time, yet other pearls of beauty, whose true lovers will grieve to see them in such custody. We do not expect much radical change in the system, and we have never been able, for we have never found the least reason, to believe in the possibility of an English School of Art in that high sense which includes the Heroic and the Religious. Nor will the wealth of Solomon, of Croesus, or of a thousand Hudsons either, be able to *force* such a thing; though it seems to be a prevailing belief in England that all things are purchasable, and that even taste can be cultivated, as grapes are in a hot-house, under "judicious management," duly furnished with forms and rules (v. the various reports and circulars of what are called the Schools of Design.) The genius of the English people, as we have before taken occasion to remark, takes, in fact, quite another direction, and it is only for a race gifted with Imagination and Sensibility that success in the domain of Art lies open. In their attempts to evoke a spirit which dwells not among them, our neighbours have of necessity thrown away their strength, and we would use this volume as an example, by way of warning to this Nation, that we have nothing to borrow or to imitate, in Art at least, from England. If the strength of our feelings upon the subject of Art on the one hand, and English taste on the other, appears to hurry us into strong words and harsh conclusions, we shall only appeal to our readers, not only here, but in Scotland, America, and England itself, to take up this easily purchased volume, and passing from all notices, reviews, and criticisms, and even from the Report itself, into the Minutes of Evidence, to consult them, comparing the witnesses, by the help of the Index, on the several subjects we have referred to. The truth will then be found infinitely stronger than we have expressed it here, or shall.

We have not, of course, space enough for a digest of so many startling revelations, and of so much valuable information; embracing every topic connected with the management of a gallery, the selection, purchasing, paying, caretaking, and repairs of pictures, the arrangement for study and for public exhibition, and even the details of what is known respecting the cleaning and varnishing of works of art, and upon the processes of "glazing" and "scumbling" used by the great painters: so many topics, each branching into so many, and so various. If we had room we could make many extracts, highly instructive as well as amusing, upon the subject of picture-cleaning especially, which has been very minutely developed before the Committee; however, the practice of picture-cleaners is, we believe, already pretty generally known and reputed as it deserves. The wholesale transactions of Mr. Farrer, [a dealer who had repainted, all over, the "Orleans Titian" after "repairing" it, Q. 2,390, &c.,] of Mr. Thane, another dealer, and of Mr. George Lance, the well known fruit and flower

painter, [who painted over some three-fourths of the Velasquez in the English Gallery, a picture of above 63 square feet of canvass, (Q. 5,121 to 5,166,) and even painted into it whole groups of figures of his own invention, (Q. 5,128 to 5,137,)] are but specimens of what is done "in the course of the trade;" but the following case, from Mr. Lance's evidence, will serve in shorter space, as an exquisitely perfect instance of the impositions against which the public is not yet quite on its guard, and which, it seems, baffle all professional experience and knowledge to detect.

"Q. 5,230, *et seq.* Col. Mure to Mr. Lance.] Have you ever restored any other picture in the ordinary course of your professional practice?—During the time I was engaged upon that picture [the unfortunate Velasquez] at Mr Thane's, he had a picture belonging to the Archbishop of York, to which rather an amusing thing occurred. [!!!] It was a picture of "Diogenes in search of an honest man," by Rembrandt; a portion of it was much injured. Mr. Thane said to me, 'I wish you would help me out in this difficulty.' He did not paint himself. I said, 'What am I to do? Tell me what you want.' He said, 'There is a deficiency here; what is it?' I said, 'It appears to me very much as if a cow's head had been there.' He said, 'It cannot be a cow's head, for how could a cow stand there?' I said, 'That is very true, there is no room for her legs.' I fancied first one thing and then another; at one time I fancied it was a tree that was wanting, and at length I said, 'Well, I will tell you what I will do; if you will let me put in a black man grinning, that will do very well, and rather help out the subject.' [!!!] He said, 'Could you put in a black man?' I said, 'Yes, in a very short time; and in about half an hour I painted in a black man's head, which was said very much to have improved the picture. [!] Shortly afterwards Mr. Harcourt came in, and seeing the picture, he said, 'Dear me, Mr. Thane, how beautifully they have got out this picture; my father will be delighted; we never saw this black man before. [!] And that is the extent of my picture cleaning. . . ."

Says Mr. George Lance, an eminent English Artist.

But the revelations of London incompetence in the management of a gallery of Art, and of the profound darkness of Royal Academicians, and even P. R. A.'s upon the subject of Art in its higher walks, (of which there is repeated evidence before us, which may at another time be not inaptly referred to), and the opened secrets of the cleaner's workshop, must not be allowed to lead us from the principal object we have proposed to ourselves in alluding to the Blue Book in this place. Wherever a public gallery of Art has been, or is destined to be, established, the attention of the managers and promoters of such an undertaking should be, without delay, addressed to the settlement of an accurately defined *system of management*, framed in the first place to secure the works of Art deposited in the gallery against all injury, and especially against the conspiracies of picture-cleaners, and their "artist" accomplices; in the next place, to secure to all students of Art the most ample opportunities and conveniences for making effective use of every work in the collection; and thirdly, so as not only to afford the general public abundant means to improve their taste and cultivate their imaginative faculties by accustoming themselves to the enjoyment of high Art, but to do this in such a manner (by the selection of a site, the architectural arrangements outside and inside the building, the mode of arranging the works contained in it, and the freedom and comfort to be enjoyed by all visitors,) as to fill their minds, for the time, with higher and nobler associations, and happier

feelings than can be drawn from the daily occupations of life, or found in an ordinary dwelling.

The LOUVRE gallery, in Paris, (though not without many faults in its administration,) is nearest to fulfilling, for a great capital, what we should desire to see, though necessarily on a far smaller scale, in each one of our cities. There the vast suite of rooms consists in fact of the apartments of a noble palace, formerly decorated to adorn the magnificence of the most powerful monarchs, still preserving that royal magnificence for the honor of Art and the purest enjoyment of a proud and imaginative people. That gilded splendour (so severe and tasteful though so brilliant) is not stained, those velvet couches are not soiled, by the *blouse*-covered artizan who spends his Sunday afternoon, not in whiskey shops, as English law and English manners may be said to drive *our* artizans to do, but in the proud enjoyment of a palace of Art which he feels to be his, which he enters with the happy confidence of a proprietor, and upon whose glorious contents he can feast his intellect and his soul with an undisturbed completeness of the fairest associations. It is this result which everywhere we ought to seek to realize, and we should take the utmost possible care that no part of our adopted system, or the administration of it, shall be able to work contrary to this spirit.

"They manage these things better in France:" and we shall take every opportunity of developing the secret of French success, because, not only is it an example for all other nations, but because in no country may the seeds of it be more easily sown than in ours of Ireland. And so the establishment of the LOUVRE, of the LUXEMBOURG, and of VERSAILLES shall on future occasions claim special notice in this sense at our hand, and we shall not neglect to point out means of availing ourselves generally of French education, especially in Art, for the improvement of our own. At present we desire but to suggest for consideration the important subject of considering and adopting a definite system for the management of public galleries of Art, and to make it as unlike as possible to that which has just been exposed in England. We have a natural aversion to *paper* systems, however,—to codes of rules, and reports, and returns, and all the parade of staffs, parliamentary commissions, boards, and *bureaux*. Nothing of the kind is here wanting, and the necessary features of a plan of management for a National Gallery, whether of 100 pictures here or of 2,000 in Paris, are of the simplest and the shortest: we shall rest content in leaving them, by way of conclusion, to explain themselves:

That the gallery should be a little withdrawn from all city thoroughfares, so that passing into it the visitor might feel himself withdrawn from the bustle of hard common life into a purer and more peaceful sphere.

That the gallery should be wide enough to permit of the free and easy circulation of a large number of people, so as to be at least as convenient to them as any private house to an assembly there.

That the utmost possible convenience, even to the borders of luxury, should be provided for visitors of all classes alike, to sit down and enjoy the works of Art without distraction.

That in the interior, at least, the building should be abundantly and richly adorned.

That the gallery should be reserved for students of Art for at least two whole days every week; and that for the public it should be opened gratuitously at least on the afternoons of all Sundays and Holidays.

That the care of the works therein, and of the observance of the rules, should be committed to a responsible, resident, salaried officer, who might be bound in penalties to the strict performance of his duties.

That the management of the Institution should be confided to a small committee, of whom at least a third should be appointed anew by the community every year, and of which at least two professional Artists should always be members.

That the committee should never allow any picture to be "repaired," under any pretence, nor any to be "cleaned," save of mere external dirt, and then only after examination and report by an artist and chemist, and only in the presence of one of the committee and of the curator, and never to have removed from it the varnish next the surface of the picture; and that no process shall be employed which is unknown to the committee and the advising chemist.

Lastly, that no picture should be purchased save upon a guarantee or warranty of its not having been "cleaned" or "repaired" for, at least, five years before, or an exact statement of the nature, amount, and circumstances of any cleaning it may have been subjected to.

ART. III.—*On Emigration Depôts and Sailors' Homes.*

ALTHOUGH it is to be hoped that the immense tide of emigration which has been for years flowing from our shores will soon cease, the condition of the emigrants at the Ports of Embarkation, so long as that emigration continues, must be a subject of the deepest interest to all, and we therefore feel no hesitation in directing renewed attention to the matter. The greater number of persons who emigrate are but scantily provided with funds; indeed, in too many instances, unfortunately, they possess barely enough to enable them to reach one of the Eastern Ports of America. There, from the constant influx of emigrants, immediate employment is exceedingly difficult to be obtained, and hence they are obliged to undergo privations little, if at all inferior, to what they suffered at home. To persons thus situated, it is of the utmost consequence that every shilling should be economised, and that the expenses preparatory to embarkation should be reduced to a minimum. So far from this desirable result being attainable at present, the poor emigrant, unacquainted with the habits of ports, is robbed by a set of sharpers, whose trade it is to live upon him. From the porter who assists him in carrying his luggage, even frequently to the agents and ship-owners, all consider him fair game for extortion in one shape or another. But even, if fairly and honestly dealt with, the total want of organization or system for the accommodation of emigrants, at most ports, is quite sufficient to drain their feeble resources. We believe we are rather below than above the mark, if we estimate the extra expenses entailed upon many emigrants, by

the want of organization, at a sum which would be fully sufficient to enable them to reach the rich fields of labour presented by the Western States, and save them from the slough of misery, which we have alluded to, in New York and other Eastern Ports.

The financial loss is not, however, the only one suffered by the emigrant, nor is it perhaps the most important. All persons are aware that sleeping in filthy close rooms, want of bodily cleanliness, and ill-cooked food, diminish the vitality of a man, and render him more subject to contagious and epidemic diseases. The lodging-houses resorted to by the emigrant are notoriously filthy dens, in which it is almost impossible to observe the rules of cleanliness, or to obtain properly cooked food; and accordingly we need not be surprised at fevers and other diseases breaking out on board ship almost immediately on leaving port, and producing such frightful mortality among persons, after living in such hotbeds of contagion. We believe that in nine cases out of ten, where fever has broken out on board of emigrant vessels, the first seeds of the disease may be traced back to the lodging-houses.

The condition of sailors in port is but little better than that of emigrants. True, there is not the same immediate necessity for economy in their case; and being well paid, they are generally in possession of sufficient money to procure good food and lodgings. Sailors are, however, proverbially prodigal of their earnings, and from their peculiar habits in other respects, are easily satisfied with any kind of accommodation; and accordingly as the result of both causes, they lead a most miserable life ashore, and frequently become a prey to want and disease.

The merchants of most ports are, however, directly interested in the condition of the sailors, and have accordingly exhibited considerable solicitude to ameliorate this condition, by the establishment of hospitals and "homes," or boarding-houses. Hitherto, however, these attempts, although to a large extent successful, have been desultory, and have partaken too much of a merely charitable character. But for the emigrant, with few exceptions, nothing has been done; perhaps because those mainsprings of most professional philanthropy—personal profit or self-glorification—are absent. In an age in which so many social questions appertaining to the physical well-being of the human race have begun to be seriously discussed; in which it is admitted that physical well-being is one of the primary elements of prosperity; and, finally, at a time when the great truth is beginning to be slowly recognised, that no class, nation, or race, can be permanently prosperous and progressive, unless when that prosperity and progression are shared in by every other—surely something should be done to remedy the present evil.

In the year 1841, Mr. John Besnard, of Cork, whose position as Emigration agent, afforded him many opportunities of learning the deplorable state of the emigrants at the ports of embarkation, attempted to remedy the evil by the establishment of an "Emigrants' Home." This establishment, got up in the most generous and truly humane spirit, at his own expense, consisted of a large refectory or dining-hall, which also served as a place of assembly for the emigrants; a cooking-house, where dinner

could be provided at once for 350 persons, and which also afforded a constant supply of hot water for washing; and dormitories, fitted up exactly like the berths in ships. The emigrants were received into this comfortable establishment one week before the sailing of the vessel, and were there provided, free of cost, with fire, light, and other necessities, and the means of cooking their food. While there, the emigrants were subjected to the same discipline as on board ship, and were thus prepared for their voyage, and, we may add, for their future life, for they learned there habits of order, temperance, cleanliness, and a taste for associating together without the necessity for stimulating drinks. Previous to the establishment of the "Home," Mr. Besnard had in vain urged upon the Government the necessity of establishing one at Plymouth, the port from which the bounty emigrants at that time sailed. No sooner, however, had he erected the one in Cork, than, instead of encouraging his exertions by making Cork the port of embarkation for the Irish emigrants, a Home, on the model of the Cork one, was erected at Plymouth, and no vessels were henceforward sent to Cork—the result of which was, that Mr. Besnard was compelled to close his Home, and suffered, we regret to say, considerable pecuniary loss. His idea has, however, been fertile; for the Home erected at Plymouth led to the establishment of one at Bremen, in Germany, and to another at Birkenhead, and, later still, to one at Southampton. The two latter, as well as the Plymouth one, were confined to bounty emigrants—a class which forms a very small portion of the total emigration. The one at Bremen, on the other hand, was erected for all who chose to take advantage of it; and as it is a model for such establishments, we have thought that an account of it might prove useful.

The Bremen Home was erected at the expense of the members of the Bremen Exchange, and was completed in April, 1850. It is a quadrangular building in the Gothic style, and has a frontage of 177 feet and a depth of 110 feet. The front basement is occupied as a kitchen, which is sufficiently large to permit of the cooking by steam of food for 3,500 persons. The other parts of the basement are arranged as stores, where the luggage of the passengers is carefully preserved during their stay in the port. These stores are so arranged that the luggage can be embarked directly from them, without any charge to the emigrants. There are also stores for provisions, and for other purposes, in the basement. On the floor over the basement are situated the offices, the apartments of the inspector and superintendent, the hospital, dining-rooms for the sailors and workmen employed in the port, and an immense dining-hall for the emigrants, which serves during the rest of the day as a sort of coffee-room. In the centre of the main building there is a chapel, where there is alternate Catholic and Protestant service when required. Over the first floor are two others, divided into dormitories, 60 feet long, 40 feet wide, and 13 feet high. Along the centre of these rooms are arranged a series of berths, 7 feet high, arranged exactly as they are on board emigrant vessels. There are also benches and tables arranged around these rooms, where the emigrants may, if they choose, take their food and arrange their purchases, &c. Those who prefer it may dine at the *table d'hôte*, which is

held every day in the great dining-hall above mentioned. Besides the dining-hall, there is another of the same size set apart for those emigrants who have already gone on ship-board, and who only await from day to day the sailing of the vessel. There is also a class of bed-rooms, capable of accommodating 100 persons, intended for those who do not wish to sleep in the common dormitories, or who have not purchased the bed furniture which it is required to have for the latter. Attached to each dormitory is a room provided with baths, washing-stands, and other requisites for personal cleanliness. Each hall has a superintendent, whose duty it is to keep order, propriety, and cleanliness; and a separate stone staircase leads to each, as in a barrack.

The hospital contains 35 beds, and is divided so as to permit of the proper separation of the sexes, and of the chronic from the inflammatory and epidemic diseases. It is attended by two physicians, a resident apothecary, and nurses.

In the centre of the quadrangle there is a court, 90 feet by 50, which serves for many purposes, especially as a playground for the children of the emigrants. Besides this court, the entire building is surrounded by another, around which are arranged stables, cart-sheds, washing-houses, &c.; the clothes washed in the latter being all dried in the attic, where proper provision has been made for that purpose.

Three offices have been established by the Government in different parts of the town, for the purpose of affording information to the emigrants on their arrival from the interior. With this information they are enabled to at once make arrangements with the ship-agents, who usually agree, in consequence of the advantages offered by the depôt, to lodge and feed the emigrants, from the moment of their arrival until they are landed in America, so that the emigrant is at no loss by any delay which may occur in the sailing of the vessels. If an emigrant does not at once conclude his bargain, he may go to the depôt, where he can obtain his food and lodgings for the small sum of sevenpence per day, the washing being charged separately. The food received for this sum consists of: in the morning, at half-past seven o'clock, coffee, biscuit, butter, and rye or white bread, if preferred; at noon, boiled beef or bacon, soup and vegetables (peas, beans, rice, potatoes, &c.); in the evening, at seven o'clock, tea, biscuit, butter, and rye or white bread if preferred. It is necessary to remark here, that each emigrant is obliged to bring his bed clothes with him, and the utensils required to take his food, and he must return all that remains over his meal; on payment, however, of a little more, he may obtain superior food and a bed-room fully furnished. The benefits which are capable of being conferred by this admirable depôt are not confined to the emigrants alone; all the sailors frequenting the port, and all the workmen employed there, may enjoy the same advantages and upon the same terms; it is thus as much a sailors' as an emigrants' home. The institution is governed by a strict code of laws, and is placed under the direction of a committee of the shareholders. *The Bremen Government exercise the right of surveillance, but carefully abstains from all interference in its administration.*

So far as the comfort and accommodation of the emigrants, while in

port, is concerned, this establishment apparently leaves nothing to be desired, and certainly contrasts rather unfavourably with the corresponding state of things in these countries, notwithstanding the large sums which are annually collected for philanthropic purposes far less worthy of attention than this. The existence of this "home" is not indeed the only advantage which the poor emigrant enjoys who embarks at the port of Bremen. For, independent of the usual system of inspection as to the condition of the vessel, the space allowed to each emigrant, and the quantity of food and water provided by the captain, such as we have in these countries, there are two or three conditions imposed upon all persons engaged in the emigration trade, which we would beg to bring under the notice of those who consider that nothing further can be done by the English Government to guarantee an observance of contracts on the part of captains, ship-owners, and agents of emigrant vessels. These conditions are as follows:—

1. All persons who charter an emigrant vessel are obliged to effect an insurance with some solvent company, *at their own expense*, for an amount equivalent to the whole passage money received from the emigrants on board; and a second insurance for a further sum of 20 dollars (£3 8s. 7½d.) for each passenger, also at their own expense. Both these sums are intended to cover all losses, sustained by shipwrecks, or delays from being compelled by stress of weather, &c., to make for a different port from that for which the vessel sailed, and, in fact, for all losses which the passengers may sustain during the voyage.

2. Every person who charters a vessel for the conveyance of emigrants is obliged to make an affidavit every time he does so, that he has observed all the rules and conditions laid down by the Government.

3. Every citizen of Bremen who engages in the emigration trade, or who hires his vessels for that purpose, is obliged to give security to the State in the sum of £800, that he will fulfil his engagements towards the emigrants, and observe all the rules laid down by the State.

If conditions similar to these were imposed upon all persons engaged in the similar trade here, and proper depôts established at all the ports of embarkation, we have no doubt that all that could be legitimately done to secure the comfort and security of emigrants would be accomplished. The attention of the English Parliament has been drawn to the necessity of establishing a depôt in Ireland; but we have no faith in the result of such a motion for two reasons: 1. That English statesmen take no interest in Irish matters; and with the fact before us, that when a depôt was established in Ireland by private enterprise, they at once established one at Plymouth, and ceased to send any vessels to Ireland, we are not very sanguine that they will establish one themselves: and 2. The establishment of a Government depôt only provides a remedy for a very small portion of the present evils of emigration, because bounty emigrants form but a very small fraction of the total number which annually leave the country; and besides, we believe the establishment of such institutions is more properly the business of harbour boards and corporations, who have in this respect an admirable example in the committee of merchants of Bremen. In conclusion, we would recommend to the attention of the committee, of the House of Commons lately appointed to inquire into the causes of the numerous accidents which are continually befalling emigrant vessels, the three regulations of the Bremen Government just mentioned.

JOURNAL OF SOCIAL PROGRESS.

ART I.—*On Country Reading Rooms and Village Libraries.*

Two months ago we took occasion to point out the want of public libraries in Ireland, and to suggest means of supplying that want;* our observations were then, however, directed rather to the necessary literary establishments in the larger towns, than to the equally important institutions of a narrower scope, but perhaps of scarcely inferior value, suitable for, and practicable in small country towns and rural villages. In very many such places there already exist rooms called "Reading Rooms," and supported more or less by private subscription; but of these scarcely any are really deserving of the name, and the greater number, on close examination, will scarcely be found worthy of a better character than the mere pot-houses they were intended to supersede. It has certainly pressed on our minds again and again, that where extreme poverty and the apparent hopelessness of any substantial improvement in means (and therefore in social position) bears down the energy of a population from its earliest youth upwards, that there indeed the opportunities of self-education will be offered in vain, for the material foundation of mental exertion is wanting, without which, and the hopes of subsequent success, it is not in ordinary human nature to engage effectively in the self-denying career of mental improvement, and the cultivation of the speculative and the abstract. And yet to material success also this is the only way. The value of political victory for the People is precisely in the ratio of the extent of opening it may secure towards the just reward of their physical labour and mental exertion, both in the moral and the material world; and the practical value of active Nationality, perhaps, lies chiefly in the protection it affords, and the impetus it invariably gives in this manner to the social and material elevation of a people. So far as Ireland is concerned, therefore, we shall not need to blame her for her backwardness in exhibiting the outward signs of such life as only really exists in a *nation* living as such, and we can never look for any lasting and fundamental improvement in her people, until the first foundation of all be laid firmly for them and their posterity. Yet because *all* cannot be achieved at this moment, we must not therefore refuse to do whatsoever little may be effected in the right direction; and not only because every step so taken does ever fortify the

* *Journal of Social Progress*, No. 3, (March,) p. 40. *On Public Libraries, and particularly on the means of establishing a Public Library in Dublin.*

final effort, and so increase the means of success in the day of trial, but also because the very exertion continually nourishes the hopes and sharpens the powers of the better sort among a people. And although in Ireland (for which we chiefly write, though the substance of these papers will, we hope, be found equally applicable in many other and more prosperous places) the supreme impediment yet presses in the manner we have described on the mass of the population, still here also in many, many districts the people are actually in a position to become more prosperous and more civilized, if only awakened to a perception of how easy it would be for them, by their own exertions, to become so; and it is to those who live in and near such districts that, without further preface, we would address ourselves, upon some of the means of realizing at least something towards results so important.

The value of well regulated reading rooms and small libraries in the less populous towns and villages of the country, corresponds with that of the greater public collections of learning and literature in the cities. It consists, firstly, in the necessity for training, however insensibly, the thinking faculties and imaginative tastes of the people in a right direction generally, and next in the importance of affording the means of education to the working population in its special walks of life. The village is the centre of a small and comparatively isolated district. The intellectual and moral wants of its inhabitants are of limited extent. Their special occupation is generally of the same character. The village then does not need the extensive and varied collections and appliances, which would be necessary for a complete library in a city, embracing, as a city must, so many different classes, engaged in so many different pursuits, subjected to so many different influences, and supplied with so many opportunities. The village absolutely requires but the sound basis of the necessary general cultivation of thought, and such specialties as may in that place be found of the greatest practical value; and these requirements are really very easily supplied, though, if it even were not so, their importance would entitle them to be satisfied by the most active assistance of the educated and affluent classes throughout the country. For what is in this respect the present aspect of things among us? The elements of primary education are now, it is true, abundantly afforded to the greater part of our growing population. But a great deal surely is required besides a tolerable proficiency in reading, writing, and arithmetic. These are but the tools by which the mind may work towards its own improvement, and through the intelligent use of which so much knowledge and skill may be acquired in life as may lead one day to personal independence, and thus among the comforts of a solid home to lay the foundations of mental refinement amidst those of material civilization. And to place the tools in men's hands, the vast majority of whom are out of the reach of that upon which alone they can be employed, is surely but a poor achievement to rest content with. The little result of all those extensive systems of primary education which have afforded so much instruction to the people for the last twenty years arises precisely from the neglect of the next step, and that one so immeasurably easier and cheaper to supply. And it is herein that the ignorant objections of

those of the opulent will find conclusive answer, who say that so much education is useless, and even injurious, to the "lower classes," (the insulting phrase so constantly in their mouths,) and only puts "notions" into their heads, the germs of so much discontent and insubordination. Society has but to supply its poorer members, the great mass of the population, with the proper materials for improving their faculties in the direction in which they may be advantageously exerted in that society (and of course for its general benefit), and those "notions," which are but the heaven-sent yearnings of the opening human soul for better and higher development, will speedily fructify in industrious exertion and the thrift which attends on it, and the result will be, not only a great increase of general prosperity and national wealth, but of order and good conduct—all these (be it further remarked) the best preparation, both moral and physical, to attain and enjoy the proud blessings of complete Nationality.

In many, if not in most of our smaller towns, there exist the materials for Reading Rooms, which have only to be well organized by the more intelligent and influential inhabitants in the neighbourhood to become all that we require for the people. The present supply for the popular mind consists almost exclusively of mere newspapers, and these are, we know, of the lowest class in point of intelligence, and nourish only party rage, boasting, exaggeration, ignorance, and flippancy. In politics we all know well enough (whatever is *said* at public meetings or in the press), that there is not even the semblance of healthy public opinion in Ireland—that is, public opinion which expresses itself anywhere, either in the public meeting or in the private coterie. The political education here is mere party education, mere blindness led by blindness or worse; and such critical or literary education as is supplied by that press which reaches the people at all, is weak, meagre, and superficial, wherever it is not positively immoral, false, and degrading, as is too much of what we find adopted here, copied second-hand, from the various efflorescent organs of neighbouring civilization. This tampering with opinion, by weakening what there is of belief or impulse in the country, while offering no new thought or strong conviction instead, right or wrong, to occupy and wring exertion from our minds, emasculates our intellectual nature. This unhealthy atmosphere of falsehood and fever, which so much emulative exaggeration keeps up constantly around us, cannot but continue to degrade us more and more, generation after generation; and if the peasantry learn to read only *this*, why then, indeed, they had better have learned to read not at all. Still, men must occupy their minds with something besides the mere routine of daily work, chiefly mechanical as it is, and so everywhere almost, where even a few live in neighbourhood, there is sure to be some sort of provision for this species of appetite. If not the poor reading-room, (that is, village club, where only the poison we have described yet circulates,) then the pot-house, where the want of true occupation for the mind is made up by another species of excitement. In these reading-rooms, and in such as may be established more widely still throughout the country, doubtless newspapers must also find a place, because men must know what is going on in the world. But it is, as yet at least, only as organs of news, not of

opinion, that we can consider them capable of anything but harm. We do not, however, urge their exclusion therefrom, because the antidote will strip them of their chief power of mischief. If the minds of the reading population be supplied with what is strong, wholesome, or practically interesting, they will care little for the vapid emptiness of the ordinary newspaper press; and, on the other hand, the proprietors of the latter will soon find it worth their while to fill their columns with material of a very different order.

"The cheapness of books is now such, that even Irish Poverty is no excuse for Irish Ignorance," wrote DAVIS,—dealing with almost this very subject,—ten years ago. And his words are still more forcibly true to-day. No village, even, need be without at least a few volumes of sound History, Biography, Travels, and accounts of the more celebrated discoveries in practical Science and Philosophy. No village even need want at least some small collection of works of standard literature, whose mission is to soften and civilize by the influence of refinement upon the imaginative sense. No village need want a few good Maps, some good Dictionaries, and perhaps some Cyclopædia of general science, compiled in intelligible language. For all these things may now be had at prices so very small, in comparison with their value and importance, as to be within the means of even the humblest circles. All that can be needed is a good selection, and perhaps some little impetus given to such undertakings in the commencement by the co-operation of those better able to afford some special assistance. Nor need an entire collection be formed at once. It may be amassed very gradually, if necessary, and as it grows its value will be felt more and more. Wherever there are even a few families who can read, and who live near each other, something of this kind—be it ever so small at first—may be organized by only a very little exertion. And wherever there is already any kind of village club or reading-room, (only *not* in a pothouse,) let but a commencement be made by adding occasionally to the stock of newspapers now and again a solid book,—whose price will frequently be only a little more than that of half a week's news.

Nor, again, in such village institutions throughout the country should the materials of the special education of the population be neglected. In different districts the people are engaged in many different occupations, and their various modes of life and species of industry should suggest much of the details of any reading-room, athensæum, or similar establishment, whether comparatively large or small. The farmer should find in his village reading-room the best attainable works upon practical and scientific improvements in the various branches of Farming, and after these the best intelligible works on Chemistry, Natural History, Geology, and the kindred sciences. In a Mining or Manufacturing district, the best elementary (and gradually even the more advanced) works upon the particular Mining or Manufacturing industry there carried on, afterwards books on other similar or cognate subjects, and always the best accounts of Mechanics and Mechanical Applications. And so on.

The difficulty in many places would perhaps be in making the necessary selections at first, and the gradual additions to them. But this difficulty

might be got over through the good offices of friends in the nearest large town where books might be advantageously procured. Almost everywhere, too, the national-schoolmaster would be found to supply an excellent librarian on the spot where as yet no reading-room or nucleus of it exists; so that, even in the poorest places, a little beginning may be made, which will rarely fail of assistance (by donations of books and otherwise) at the hands of the neighbouring gentry, the better educated because richer classes of the community.

Had we an organization like that of the *communes* of France, (of which indeed we have some day to give our readers some account,) such village institutions might well be supported by a small local tax, which would very soon come to be gladly paid, for they would be soon felt to be effective schools, the most effective while the cheapest. "Were such a room [reading-room] in every village," says DAVIS,* and how truly, "you would soon have a knot connected with it of young men who had abjured cards, tobacco, dissipation, and more fatal laziness, and were trying to learn each some science, or art, or accomplishment,—anything that best pleased them, from mathematics to music." . . . But with such a prospect, even with such a possibility before them, even before the advent of a public system of organization as in France, may we not expect that the richer classes, who have tasted the blessings of education themselves, will perform such duties of assistance as we have pointed out?

In the better country towns further developments of course would suggest themselves, and among these, occasional public teaching by way of Lecture, upon What to study, and How to study, upon the general and special Uses of the Books and other means of education found in the district, upon the current Popular Fallacies, and upon all the various means of self-help and self-advancement. Not indeed that we should wish to see here the "popular lecturing" on the American plan, or at least as it is, we believe, practised there. Here in Ireland we want the rudiments of practical knowledge, and are not yet far enough advanced to gain anything from the amusement of superficial public essayists. But we are persuaded that a few earnest and solid lectures, of the kind and upon the subjects alluded to, would kindle much zeal, and arouse the healthiest excitement of emulation.

These developments are, however, possible only in the more populous and wealthy places; but even in the smallest village the little reading-room would itself tend to stir up the energy of at least many of the growing population, for such institutions (even on a small scale) would naturally become the centres of village thought, and would gradually break up that isolation which is the chief bar to the social advancement of the more distant and the rural districts. Were there generally such impetus given to thought, and such opportunities afforded to the latent talent of this people, many years would not elapse before this whole Nation would feel the

* Selections from the *Literary and Historical Essays* of the late THOMAS DAVIS. James Duffy, Dublin, 1846. (1s.) p. 245, and see p. 251-2.

warmth of awakening life throughout its every nerve, and soon should we rejoice in the end of our darkness and degradation.

We do not need to say more here. If we have but struck the key of our subject, it will have been sufficient: for its importance—all the ramifications of its importance—are infinite, and will suggest themselves to every one. The provincial press, the gentry of the country, and besides these, many other individuals living in comfort in the midst of struggling ignorance and darkness, have it in their power, at a very little cost and with very little exertion, to accomplish all that we have suggested. We shall only remind them here of their power, in the words of the same friend whom we have before quoted—their friend and ours—in speaking of the promoters and committees of just such institutions, which he also, several years ago, had exerted himself to have established throughout the country:—"They can give advice and facilities for improvement to young men of promise; and they can make their circles studious, refined, and ambitious, instead of being—like too many in Ireland—ignorant, coarse, and lazy. The cheapness of books is now such, that even Irish poverty is no excuse for Irish ignorance,—that ignorance which prostrates us before England. We must help ourselves, and therefore we must educate ourselves."

ART. II.—NOTICES OF BOOKS, &c. (No. 1.)—*The Practicability of Improving the Dwellings of the Labouring Classes, with Remarks on the Law of Settlement and Removal of the Poor.* By CHEYNE BRADY. Svo. Pp. 59. London: Stanford. 1854.

Of the two subjects considered in Mr. Brady's pamphlet, we purpose at present giving our attention to but one—that which relates to the improvement of the dwellings of the working classes. In a moral, social, and sanitary point of view, it would be difficult to find a subject of more importance, or with more direct bearing on the interests of the community at large, than that we are about to consider. It is one the influences of which reach far more deeply than is at all suspected by the votaries of the fashionable philanthropic dilettantism of the day. It would, however, be out of place here to speculate on the possible results to the working classes of the extension to their sphere of action of this and other principles of organization and association of capital, which have done so much to secure the stability, permanence, and social power of the middle and upper classes. Like causes will ever produce like results; the extension and application of social principles which have produced good and permanent results in one class, is but a question of time as regards the community. Class reacts upon class, and with an equal force in the direction from below, and that from above, if not in a great many important respects, greater in the former.

Few of those whose business, curiosity, worse or better motives, lead

them for a brief hour from the great thoroughfares of life to the narrow and crowded streets, lanes, and alleys, where dwell the working men and those who have no work, know that it has been proved by experiment that it is a good, safe, and profitable investment of money to erect commodious, well-ventilated, and well-drained houses or cottages, and to let them in whole or in parts at rents which can and will be punctually and certainly paid by various classes of tradesmen, artisans, and even day labourers.

Those who now for want of any better accommodation available with the means at their disposal, are condemned to live in close and stifled houses, in which it would seem as if ingenuity had been exhausted in endeavours to exclude air and light, and to secure a constant supply of the foulest, most noisome, and unhealthy exhalations, can afford, and would gladly pay for a set of rooms or a cottage, properly lit, ventilated, and drained. This latter proposition would perhaps hardly require proof. There are some, however, sceptical about everything which claims a moral instinct or the possession of a rightly-adjusted reasoning faculty by the "lower classes;" and it is therefore as well to state that it has been proved by experiment in large towns, and most abundantly proved, that working men will gladly apply for and punctually pay for improved house or lodging accommodation. The first proposition did require to be tested experimentally; it has been put to the proof, and it can now be confidently stated, that it is a safe and profitable investment to build houses or cottages for the accommodation of the working classes.

These must be regarded as the two great cardinal points in this important social movement; they constitute the base on which alone we can rest any favourable anticipations, or indulge any reasonable hopes of the extension of this great principle of social reform (for we hold it is no less) to a degree at all commensurate with the magnitude of the evils which it is intended to counteract.

We do not wish to be thought unjust to the efforts of those who turn from the absorbing and attractive frivolities of fashion, or the graver occupations of business, to consider modes of alleviating the conditions of their fellows. We know that there are many with whom such impulses originate in deep thought and earnest feelings; many, too, with a less prompt energy, love good, and would wish it done. The efforts of such men must ever be productive of good. But we do feel called upon to raise our voices against a system, now too prevalent, of putting measures of great public utility—we could even say, in many instances, of great public necessity—on the false, unreal, and ephemeral basis of fashionable charity and patronising philanthropy. Efforts thus originating, and with no more real foundation than is derived from the weight of aristocratic patronage, are but weak, temporary, fitful, and, by their failure, often irreparably injure a cause which could not but have succeeded if placed on the secure basis of its own intrinsic merits, when every man who joined in it or worked in it would constitute a firm pillar of support.

To improve the dwellings of the working classes is a scheme which, in its requisite extension, would comprehend the improvement of large sections of our cities; it is one which even the sceptical will admit would be

a measure of great public utility, and which, we doubt not, many will hold with ourselves to be one of great public necessity in a sanitary point of view. It may be a question whether such a scheme is not in the highest degree deserving of the direct attention of the civic authorities; but it is manifest, that to promote any extensive system of individual or associated action for the effectuation of this object, there is but one way, and that is, to show that it is not only a safe but a profitable speculation; not only a means for the manifestation and exertion of philanthropic principles, but a remunerative investment for capital. We will therefore adduce some of the most remarkable instances of the success which has attended the efforts of societies and individuals in the erection of dwellings for the labouring classes. We are indebted to Mr. Brady's pamphlet for the means of illustration. We may observe that he has, within a very small compass, most admirably succeeded in bringing together a large body of evidence, drawn from the most varied sources, and which no individual could have acquired without considerable labour and cost of time and talent, though the limits which he has assigned to himself do not allow him to enter on the subject as fully as its vast importance demanded.

Several projects have been undertaken for the purpose of supplying lodging accommodation for the working classes. Of these may be mentioned the establishment of "Model Lodging Houses" for single men and single women; the erection of houses to accommodate several families, or the remodelling of existing houses; and the erection of self-contained small houses or cottages, with yard or garden, for single families. We believe that a very serious error in principle has been committed in the adoption of the term "Model," and its application to any house or cottage destined for the residence of an independent workman or labourer of any kind, who is able and willing to pay for a room or a cottage. It implies what does not exist, some kind of *charitable* relation, however remote or indefinite, between the tenant and the landlord, and we trust that the spirit to repudiate this relation, as false and unsound in principle as it is actually unreal, will never cease to operate in the mind of the independent artisan. We may observe that this feeling has already found expression. At a public meeting in London, Lord Ingestre stated that many workmen did not like model lodging-houses, which they regarded in the light of a charity, and had asked why they could not have a house as much their own as any lord. What object it subserves except that of implying "patronage," "amelioration," or damaging the scheme by the suggestion of charitable relations which do not exist, we can in no way conceive, and we trust therefore to see the word "Model" exploded. The movement may be considered to have been first prominently brought before the English public by the establishment in London, in 1844, of "The Society for Improving the Condition of the Labouring Classes." The first operation of this society resulted in the erection of the "Model Buildings," near Bagnigge Wells, which consisted of nine small houses and one large one. The buildings were occupied in 1845, and in their erection a sum of £5,325 was expended, in addition to which the site cost £1,045; the rents average £391 per annum; taxes and current expenses, £83; which leaves a

return of $4\frac{1}{2}$ per cent on the cost of the buildings, and 4 per cent. on the rent of the land. In 1849 this society erected a range of buildings to accommodate 54 families, in Streatham-street, Bloomsbury; it is stated that the arrangements for insuring the privacy and independence of each family are excellent and effective. The land on which the buildings stand is rented at £50 per annum, the cost of erection was £8,860, yet there has been a return of $5\frac{1}{2}$ per cent. on the outlay. The operations of this society have, however, been exceeded in magnitude by those of "The Metropolitan Association for Improving the Dwellings of the Industrious Classes," which obtained a royal charter of incorporation in 1845. The capital for the Metropolis is £100,000, and by a supplementary charter, £1,000,000 for the Provinces; the shares are £25 each. This association has erected, in St. Pancras-road, 20 sets of tenements containing two rooms, and 90 containing three rooms, the rents varying from 3s. 6d. to 6s. 6d. per week; the ground in front of the buildings is enclosed, and forms a playground for the children, while in the rear there is a wash-house. These buildings cost £17,736. The Albert-street Family Dwellings, containing 60 sets of rooms, cost £16,297. Not to enter more into the details of the operations of this association, it may be stated shortly that the total cost of the dwellings for families amounted to £33,000, and the profits were a net per-centage of nearly £5. Under the supplemental charter four branches of the association have been established at Ramsgate, Brighton, Dudley, and Newcastle; the most valuable feature of their charter, however, is the limitation of individual liability to the amount of shares severally subscribed for. Another very successful society is "The Windsor Royal Society," which is registered as a public company under the Joint Stock Companies Act; they have built cottages, purchased and remodelled large houses; their directors state in their report, that the society, when in full operation, "may reasonably look forward to a permanent dividend of 5 per cent. on the capital invested."

Individual enterprise has also been attended with marked success in the furtherance of this movement. Mr. Illiard realizes about 8 per cent. on the money invested in the erection of 12 houses for four families each, near the Shadwell Station of the Blackwall Railway. In Glasgow, Mr. Lumsden has erected a set of dwellings containing 31 tenements, all profitably let. In Edinburgh, the Pilrig Model Building Association has erected 44 houses, at an average expense of £92 each; the rental, after deduction of all expenses, yields an annual dividend of 5 per cent., leaving a surplus of £45 to form a sinking fund. These dwellings are amongst the most commodious and excellent that have been erected by any society; each has a separate entrance, is well ventilated, and is supplied with gas and water; and a plot of ground is attached to each house. In more than twenty places in England and Scotland, movements similar to the above have either been commenced or are actually in operation. In all instances in which societies have been in operation for even a limited time, it has been clearly shown that the investment is a profitable one.

Such is a brief sketch of the present condition and prospects of this most important movement, and in no department of our social economy

is there more need for reform. Nowhere are the transitions from the glitter of the fashionable thoroughfares to the dilapidated streets and the close and crowded lanes, inhabited by the poor and the working classes indifferently, more sudden and startling than in Dublin. On the other hand, numerous centres exist well suited by their aspect, elevation, advantageous falls for drains and sewers, for the erection of rows of cottages or squares of small houses, in districts where property could be readily purchased, and there is no doubt that capital would be *safely* and *profitably* invested in supplying the wants of the Dublin artisans in improved house or lodging accommodation. Such is the light in which this movement must be regarded; for if it gain no more solid support than the patronage of fashion or the impulses of ephemeral philanthropy, we despair of its ever reaching that development which alone will enable it to remedy widespread evils.

In treating of this subject it would be unjust to omit to mention the names of our fellow-citizens, Sir E. Borrough, and Messrs. Vance and Pim; to the exertions of the two former we owe the establishment of the "Model" lodging-houses, admirable in everything except name. To the enterprise of the Messrs. Pim, their workmen are indebted for the comfortable cottages erected at Harold's-cross. With such excellent examples before us, we cannot doubt that admirable materials exist in Dublin for the formation of a "Building Association" worthy to rival those of London or Edinburgh.

ART. II. (No 2.)—*The Fine Arts, their Nature and Relations*; by M. GUIZOT: translated, with the assistance of the Author, by George Grove: with illustrations drawn on wood by George Scharf, jun. London: Thomas Bosworth. 1853. (Price 14s.)

WE have already taken frequent occasion to insist on the very great importance to society of cultivating acquaintance with the principles of the Fine Arts, so as to become more alive to their influence, in an age in which the prevalent tendency of the human mind (at least, so far as we can judge from such influences as are suffered to penetrate to this country) is so decidedly utilitarian; a tendency which does and will discountenance, and, with success but too sad, reach even to neutralize and suppress the suggestions of the Spiritual. The great value of Art lies in its being one of the languages of those higher powers of the Soul, one of the exponents of those purer emotions and more heavenly ideas, which are wholly unconnected with the world's everyday life, its gains and its losses, and the pomps and vanities of its petty schemes of social ambition. The God-like part of the Soul of Man is quite above all these things, and in everyday life it seldom speaks: and yet, out of the bounds of this poor temporary world, it is precisely that part of Man's Soul *alone* which will be found to have *any* value. It is the spiritual improvement which the opportunities of a finite existence permit us to attain which is the whole end of human life: the wealth and station to be achieved by industry and "success in

the world"—even when honestly achieved, which is rare—will profit not at all. This is the teaching of Religion, with which Faith has satisfied and to which it has accustomed our minds. But the suggestions of the Spiritual do not often come by mere reflection, nor do they always last throughout the year merely because we are so often reminded of them during the little hours of our devotional exercises. And so abroad, throughout all the face of Nature, God has lavishly impressed those suggestions, leaving no one creation of His hand, however varying in size, in intention, in importance, in form, without its own peculiar power of *expression*, whereby it is able to suggest a universe of the grandest, the purest, and the most spiritual thoughts. And it is the province of the Fine Arts, (which are only the reduction into Form of the Conceptions of those men upon whom God has conferred a more peculiar sensitiveness to the Spiritual, and thus a deeper insight into the meaning of that Expression of which all Natural forms are capable—men whom we call *Artists*.) it is the province of the Fine Arts, we say, to supply, in the midst of the Artificial Life of Civilization, in our houses and our cities, those same suggestions of a fairer world of thought, which the Imagination, well directed, is found able to express through the infinite forms of Beauty.

But though we have desired, and do still intend constantly to urge on those of our population whom this Journal may be expected to reach, the true aim of Art, and the importance of its cultivation, or at least of the cultivation of some knowledge of it and taste for it, especially among those whose ordinary avocations are those of manual industry or of commerce, still it is for us only to point out the direction rather than to supply the means of pursuing it in detail. And since the nature of our enterprise does not permit more, we shall hold it as part of our duty at least to inform our readers where and how they may procure for themselves those means. Amidst the vast piles of mere rubbish which the press in the nineteenth century annually pours out, (and of the worst sort of which unfortunately the current "cheap literature" is chiefly composed,) much of course has the pretension to instruct in the various provinces of Art. For the most part these guides are wholly unworthy of trust, but indeed for the most part they consist of mere words, without any meaning at all. We shall not therefore think it worth while to notice even the existence of books of this class, unless it chance that any of them may serve as a vehicle for ideas so directly poisonous as to demand some exposure by way of antidote. And the same remark will apply to the richer and costlier rubbish of the English press, though here indeed the price prevents any very extensive mischief from being bred by it. There are, however, occasionally printed in the English language works, some translated and some even original, which with more or less force explain the true principles or make plain the real value of Art, and as in this country there is a singular dearth of real criticism or literary analysis, we shall, in the course of our more humble labours, endeavour to let no such publication, so far as our limits will allow, to pass without some notice by which our readers may be informed of its value.

The volume whose title stands at the head of this paper is not, and does

not pretend to be, a detailed treatise upon the Fine Arts at all. It has nothing of the technical in it; it does not profess to teach the means or mystery of Art; and even its general tone cannot be said to be commensurate with the higher view of the subject and of its importance which we have just indicated; nor indeed will the name of M. Guizot lead to any such expectations. His aim in this work is simply to suggest to the general reader some of those general considerations upon the province of Art itself, and on the characteristics and true limits of its various departments, which are indeed essential to a right understanding of the subject, and of course to the legitimate practice of Art, but which have been ignored by too many modern professors, (leading astray of course the public who believe in them,) and the neglect of which has gradually produced that degradation of taste, or it may be said, perhaps, that incompetence to form any *opinion* at all, which is generally observable among even the better educated visitors of the sculpture or picture gallery. And in addition to, and illustration of, his "Essay on the relations and differences of the Fine Arts," the author has appended, what indeed forms the bulk of a very graceful volume, "Descriptive Criticisms" on certain of the great pictures of the Italian and French Schools in the Gallery of the Louvre, or which were there between 1808 and 1814, when M. Guizot made the notes, now edited by him for the public, during a studious examination of the marvels of Art which the victorious "armies of France, in their march over the world, had amassed and brought back with them to the metropolis."

The philosophy of M. Guizot, as is well known, is by no means of the most Spiritual, but he is full of the good taste of a highly cultivated mind, and the observations of a man of so much ability, so much learning, and so much energy of character, upon such a subject as that of Art itself, and of the great individual Works of Art, must be full of interest. The present Essay and Critical Descriptions possess certainly the more value, because, though doubtless corrected by the experience of mature years, they are the work of one still young, of one who, in those earlier days at least, had not shaken himself free from the natural enthusiasm of French youth, whose influence the growing ascendancy of that purely rationalist principle, with its perpetual compromise of opinion and low tone of sentiment, which characterizes the *doctrinaire* philosopher, had not yet overthrown. And the professional artist, too, will often find the speculative criticism of the philosopher (if he be also a man of refined taste and extensive observation) of no small value, because he sees with the eyes of those for whom the language of Art is intended, and he is not led away by those mere considerations of technical excellence and difficulties of manipulation overcome, upon which the professional man too often so closely fixes his attention as to forget the general purpose or aim of his piece, which is of course the very essence of it after all. And M. Guizot, in the conclusion of his Essay, with great truth and some eloquence, urges still further the importance of philosophical investigation into the "ground of the nature of each of the Fine Arts, and of the relations or differences which unite or separate them."

"In whatever work he is engaged, the Artist is subject to laws which are founded in his nature as a man, and in the nature of the substances with which he deals. To trace these laws will be the endeavour of every true philosophy of the Fine Arts. The student must commence his task by humbly following in the steps of genius, and patiently examining into her methods of action; he will thus endeavour to discover the direction in which she is tending, and when he is satisfied that he knows what genius is, the height she may attain to, and the methods by which she must reach that height, he will dare to take his place at her side, and illuminate her path with that torch, which, but for her, he would never have been able to kindle."—p. 47.

The scope of the author's own discourse is of course but limited, yet though so short an essay, it suggests with abundant clearness a great part of the more important principles upon which the subject hangs, and with great grace suggests the proof of the truth of each, even in the very statement of it; so that he has abundantly succeeded—looking at the subject as a lecturer like Guizot must look at it, not indeed from a very lofty stand, but still from one much higher than most modern writers—in performing his promise of (to use his own words): "indicating the principal points of view from which the Fine Arts must be observed if they are to be intelligently and correctly appreciated; . . . and from the nature, aims, and processes of each of these Arts, to deduce the laws to which it is subject, and thus to lay the first steps of that ladder which is mounted with rapid strides by genius, and leads at last to that height of perfection which is at once the object and the result of her most daring attempts."

The first division of his subject is suggested by the much and long agitated question of the relative superiority of Painting and Sculpture, for which M. Guizot thinks it more to the purpose to substitute an inquiry into the grounds and limits of each. And his remarks are generally just, and often conclusive in pointing out the dangerous mistakes produced by the imitation by either Art of the effects peculiar to the other. For "the paths of the Painter and the Sculptor are quite distinct," and generally the subject, and always the treatment of it, that is appropriate for the one is quite unsuitable for the other. And the writer immediately defines the peculiar bounds of each, when he remarks that the plastic arts in general being able to represent either "actions" or "situations," ("in which are included all the aspects under which man and nature present themselves to them,") the former suggests his proper subjects to the Painter, and the latter to the Sculptor especially. The aim of the Sculptor must ever be simple Beauty; he must preserve simplicity both of subject and treatment, or he becomes untrue, (as in the instance of *Paquet's "Milo,"* in the Louvre, referred to in M. Guizot's criticism, and engraved at p. 17); or altogether mean and even ludicrous, (as in so many of *Bernini's* fantastic groups, and those of his school, such as the five monstrous compositions by *Fr. Bertos*, said to have belonged to Napoleon, and lately at the Dublin Exhibition). And he must accordingly submit to very narrow limits in his rendering of motion or action, else he fails to convey the idea; and wanting that, the very effort makes the marble seem yet more dead and heavy (as in the small group of the *Ascension*, for instance, which stands over the high altar at *St. Andrew's, Westland-row*,—we believe it is by *HOGAN*,—which

as a bas-relief, and so partaking of the character of painting, would have been beautiful enough). And with reference to the simplicity of Form thus required in Sculpture, M. Guizot proceeds to remark on one or two points which have often struck us before, and which it would be well for certain of our ablest professors, whom we could name, to consider in future:—

“Were the Sculptor to attempt to imitate nature in minor details, he would fail to produce the effect which she produces, while he would miss that which is within his reach. Thus the great masters of antiquity treated the hair of their statues in masses, because they felt that the nature of marble forbade its being divided into detached filaments, and that any attempt to produce actual lightness by such means would result in an opposite effect, while by disposing of it in broad and well-defined masses, and by attention to light and shade, [the knowledge of the ancient Sculptors of the effect of which is probably the main cause of the simplicity and breadth of surface in their statues,] all the appearance of lightness could be obtained. *Thus, too, they put no pupils into the eyes of their finest statues*, because as the pupil is not really a projection, there would be in the small cavity necessary to mark it, a mean appearance [besides the untruth], inconsistent with a grand effect: and they also probably wished,” adds M. Guizot, “to avoid giving the eyes a fixed and unnatural look.”

The author goes on to consider the requirements of Design in Painting, and with great clearness directs attention to the independent sphere of the Painter, whose especial subject lies rather in the *action* than in the *actors* of his picture, and whose studies must embrace the art of Relief in a much larger and complete sense than those of the Sculptor. The Sculptor needs not to “detach his figure from the back-ground.” The Painter must find in the Art of Relief results far more perfect than could be learned in studying from the marble. In a painting:

“A figure must be surrounded with air, and must look as if it could be walked round: the eye must be tempted into the belief that it is standing out from the canvas,* or rather that the canvas is far back from it. This is the power which was possessed by Paul Veronese, by Guido, Caravaggio, the Caracci, and Corregio; a power which is only to be acquired by the study of nature,—that nature in which the scene of the picture is laid, and which is to form its back-ground. . . .

“It is plain, then, that the Painter has nothing to borrow from the Sculptor. . . . The Painter must study nature; from her he must acquire that facility, grace, simplicity, and truthfulness, of which indeed admirable examples may be found in sculpture, but which can hardly be said to be borrowed thence, even by him who imitates them, because possession of these rare excellencies is only to be obtained by the observance of living forms.”†

* In France the painter too frequently applies himself almost solely to producing this “effect,” and among the vulgar the “illusion” is satisfactory. This is emphasising (and often exaggerating so as to falsify) the accident at the expense of the essence of the subject; and M. Guizot of course does not mean to countenance so fatal an error. Yet we have selected this extract, because among us the Painters are in the extreme of forgetting to learn the necessity of representing this “aerial perspective” at all.

† “We must make,” Antoine Caypell used to say, “the figures in our pictures living models of the antique statues; not let the statues be the originals of our painted figures.” [A beautiful example of the success of a great painter in this particular will be found in Lord Portarlington’s NICOLAS POUSSIN, now at the Exhibition of the IRISU INSTITUTION, (R. H. Academy, Abbey-street,) the *Bacchanalians*, No. 56 in the Catalogue of the I. I. The delicacy and force with which the aerial perspective is preserved in this group, of which each figure seems the *living* original of an antique statue, leaves absolutely nothing to be desired.]

M. Guizot completes his *Essay* by observations upon the province of the Engraver, as the translator of the Painter as it were into another tongue, and explains with characteristic clearness the legitimate means by which the required effect is reached in this third Art, the true principles of which are perhaps less commonly understood than those of the others. But we have no space for further extracts, and those we have made have been selected even less as specimens of a book we desire to recommend to our readers and to all schools of Art, (in the schools of "Design," the *Masters* would find much to learn in it of the first principles of Art,) than as the expression of solid matter of instruction and reflection upon the subject in some of its bearings, in which, though extremely important, it is here almost unknown.

Of the bulk of the volume we only need to say that it consists of a series of admirably-written critical descriptions of some of the masterpieces of Raffaello, Giulio Romano, Correggio, Andrea del Sarto, Bassano, Paolo Veronese, the Caracci, Palma, Domenichino, Guido, and Caravaggio, and of Poussin, Lesueur, Santerre, De la Hyre, and Vanloo. In these a great deal of information upon the schools and the styles of the various Artists is interwoven with simple narrative and elegant description; and though the critical opinions of M. Guizot are not always very lofty or very profound, they are at least full of intelligence and thought, and may often suggest deep truth, though not invariably founded upon it. This edition (to conclude) is very elegantly printed, and is illustrated by seventeen drawings on wood, representing in outline the principal subjects of the author's criticisms. The drawings appear to have been correctly though not very tenderly executed, and the wood engraving, though coarse and sometimes inaccurate, (as in the rendering of Raffaello's conceptions in England one must expect,) is bold, and furnishes a fair memorandum of the designs, and of the great engravings after the originals.

A paragraph from the Preface (on which the reader will not think so much space thrown away) may serve as an appropriate concluding reflection:—

"The study of Art possesses the great and peculiar charm, that it is absolutely unconnected with the affairs and contests of ordinary life. By private interests, by political questions, and by philosophical problems, men are deeply divided and set at variance. But beyond and above all such party strifes, they are attracted and united by a taste for the beautiful in Art; it is a taste at once engrossing and unselfish, which may be indulged without effort, and yet has the power of exciting the deepest emotions; a taste able to exercise and to gratify both the nobler and the softer parts of our nature—the imagination and the judgment, love of emotion and power of reflection, the enthusiasm and the critical faculty, the senses and the reason. . . . The very differences and debates arising from an intellectual exercise at once so varied and so animated, have the rare advantage that they may be eager without becoming angry, that in their pertinacity there is nothing of rancour, and that while they rouse the passions, they at the same time disarm them of their bitterness."

This work, then, is eminently one of those which should find a place, not only on every drawing-room table, but also in the collections of the less affluent classes; and its very low price (for so elegant and beautifully printed a volume) should gain it admission to very many even of these.

ART. II. (No. 3.)—*Les Poules bonnes pondeuses reconnues au moyen de Signes certaines, et indications pratiques pour faire des poulets et des volailles grasses.*—Par M. ORANGE, *Médecin Vétérinaire, Paris*, 1853. (Good laying hens distinguished by certain signs, and practical indications how to fatten chickens.)

NOTWITHSTANDING the practically unlimited demand for eggs, and the comparatively high price they fetch, the management of poultry as a branch of household industry is but little practised in Ireland. Immense numbers of eggs are indeed annually exported to England, but the total production is not one-tenth of that which it easily might, and ought to be; and there are even districts where eggs are comparatively scarce. The same observations apply to the fattening of fowl for the table, which is but very imperfectly understood in this country, although it might be made a source of wealth, as well as of one of the most nutritious elements of food. Nowhere is this branch of industry better understood or more cultivated than in France, and it is incredible how much it influences the condition of the peasantry there. As may be anticipated, very many books are published upon so popular a subject; but, as among ourselves, most of them are mere reproductions of one another. We are glad, however, to be able to mention a complete exception to this rule, in the book whose name we have quoted at the head of this notice. It is, indeed, a book well worthy of the attention of all who take an interest in the rearing of poultry, and although strictly speaking, the subject comes more within the province of an agricultural journal, we have been tempted to notice it in the hope that some more attention would be thereby directed to this lucrative, but yet little developed Domestic Industry.

The book treats generally upon the subject of poultry, especially upon the fattening of pullets, and is, perhaps, at once the most complete, and at the same time, the most intelligent authority upon the natural history of domesticated fowls, their different varieties, the crossing of breeds, their management and feeding, artificial incubation, the preservation of eggs, &c., which we have ever seen. The most novel feature in the book is, however, the portion devoted to the signs by which those hens which are capable of laying the greatest number of eggs, may be recognized. These signs are of two kinds. The first is afforded by the comb and beard: the more vivid dark scarlet colour these parts are at the period when laying commences, the better layer is the hen, and therefore, the more eggs she produces. At the same time that these organs become darker coloured, the flap of the ear in contact with the beard becomes much paler; this is not a mere contract of colour, but an organic change, which may be even anatomically shewn. In the case of moderate or bad laying hens, the red colour of the comb and beard gradually becomes paler, and the flap of the ear on the other hand is of a dirty white, and sometimes even of a yellowish rose red. The second sign is afforded by the appearance of the tuft of feather around, and especially under the anus; the larger this tuft is, and the more it resembles an artichoke near its period of flowering, the better layer is the hen. For further information upon this important subject, we must refer our readers to the book itself.

JOURNAL OF SOCIAL PROGRESS.

ART I.—*On the teaching of Drawing in Schools of Art and of "Design."*

[We had already made some progress in the preparation of a paper on this subject, with a view, in the first place, to make our readers acquainted with the entire ignorance of principles with which those who conduct the Schools of Art, "Ornamental Art," and "Design," manage the existing establishments under the auspices of the London Board of Trade; and in the second place, to direct public attention to some, at least, of the first principles of Artistic education; when the following document met our eyes. It is the Report of a special commission charged by the French Government to investigate the principles and report on the practice of the Drawing Schools of France (long known as the first in Europe); and the future management of that department of public instruction in France has been since fixed, by ministerial decrees, in exact accordance with the recommendations of the Commission. The report is one of the ablest and most complete we remember to have met with, even among Reports of a class for which the French are so justly celebrated; and it appears to us to contain so much solid instruction, and of a nature just now so important in this country, that we have thought it the best fulfilment of our duty to our readers to make room for it almost entire. The original will be found in the fortnightly *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, for March, 1854 (2nd series, No. 5). The Commission was composed of MESSRS. FELIX RAVAISSON (Inspector General of Superior Instruction), BRONGNIART, INGRES, PICOT, SIMART, BELLOC, EUGENE DELACROIX, HIPPOLYTE FLANDRIN, MEISSONIER, JOUFFROY, DUC, and PILET: the Report is addressed to the Minister of Public Instruction, and the able reporter is M. RAVAISSON:—]

All Bodies (independent of all their other properties) are situated in Space, and they have all a certain Figure; these are the essential and fundamental attributes of Bodies—these are what Geometry applies itself to, these also are the objects of Drawing: Geometry explains them, the art of Drawing represents their forms.

Situations and Figures result from the relations of dimensions; in other words, from Proportions. The Art of Drawing, considered generally, and all those different arts which are included in the common name of the Arts of Design,* may then be defined as the representation of proportions, as Geometry may be defined as the science of them.

* [*Arts du dessin*; but *dessin* means strictly *drawing*, and not exactly what the word *Design* may be understood to convey. The English language does not seem to possess an adequate word for it.]

In representing the proportions of things, (all their other qualities being put out of view as far as possible,) Art teaches us to be better acquainted with them, but in a manner and for a purpose peculiar to it. We do not truly know things unless we understand them; that is, understand them in their relations, in their connection with their principles. Art should therefore, like Geometry, make us acquainted with Proportions, by teaching us their principles. But by the principle of a thing we mean either the Elements of which it is composed, or, on the contrary, the Form which it ought to have, and which is the object for which its elements are brought together, or, what comes to the same thing, the thought which has made it what it is. The first of these is the point of view of Geometry; the second is strictly that of Art.

Geometry then makes us understand the proportions of a thing by analysing them, by decomposing them; Art makes us understand them by bringing out, by rendering more vivid, the character of that Form which constitutes their unity. "The Mathematics," says LEONARDO DA VINCI, at once artist and mathematician, "consider the proportions of things, but make no account of their quality."* That to which Art addresses itself, on the contrary, is that quality which constitutes what is called the *character* of things, that quality by which they have each their meaning, and which is, consequently, the expression of the Spirit from which they proceed.

In representing the proportions of things, it is then the Spirit which it is the object of Art to express.

Among living beings, the relative situations of the limbs and of the moveable part of the features are variable at the pleasure of the affections or the will which determines their movements; by these situations, then, the will and the affections are expressed, the determinations, the internal motions of the immaterial principle which animates and moves matter. Hence the evident possibility of representing the Spirit itself by means of the Art of Drawing.

"Art has two things to do," says LEONARDO DA VINCI; "it must represent the body of Man; and, by the gestures and movements of the parts of that body, it must represent also his Spirit."† And the same idea is expressed almost in the same words in the conversation between Socrates and Parrhasius, related by Xenophon.‡

Not only is it one of the provinces of Art to express these movements; it is even, according to LEONARDO,§ according to MICHAEL ANGELO,|| according to POUSSIN,¶ as well as according to the ancients,** the highest and the most difficult. And, in fact, it is in the imagination of movements, above all, that the great masters exhibit their powers; it is, above all, by the character of the attitudes and gestures that, in the most unfinished sketch, or in the ruins of works the most injured by time, the genius of a Leonardo da Vinci, a Fra Bartolommeo, a Perugino, a Raffaele, a Michael Angelo, reveals itself, or the still more sublime genius of a Phidias.

The highest department of the Art of Drawing, then, is "to represent Thought by movements and gestures which accord with it."††

If it is by the movements of the body that the Spirit manifests itself with the greatest clearness and certainty, the Figure also makes it known and bears its imprint. The fault into which Painters often fall, of designing the figures they invent after their own likeness, is a proof, according to LEONARDO DA VINCI, that our body is such as our soul is pleased to make it. "This fault," says he, "should be strongly resisted, because it is born with the Judgment. For the soul which reigns in your body is the same which is your very judgment, and it satisfies itself with works like to that which it has itself made in composing your body."‡‡ Whatever this opinion is worth, and whether we admit that it is this same spirit by which we Think that has given the form to our bodies, or another spirit, it is

* *Trattato della Pittura* (Roma, 1817, 4to), p. 11, 29.

† *Della Pittura*, p. 110.

‡ *Memorab.* lib. 10.

§ *Della Pittura*, p. 90, 107, 110, 113.

|| *Condivi, Vita di Michelagnolo Buonarroti*, 60.

¶ *Poussin, Osservazioni sopra la pittura* (Vellori, *Vite de pittori*, etc. p. 460).

** See Aristotle. *Polit.* viii. 5; *Poet.* c. 6; *Illyri, Hist. Nat.* xxv. 10.

†† *Della Pittura*, p. 113.

‡‡ *Della Pittura*, p. 78. Michelangelo said: Ogni pittore ritrae de medesimo bene. (*Vasari, Vita di Michelagnolo Buonarroti*, Firenze, 1823, 8vo, vol. v. p. 157).

always certain that the Figure of each body is in all its parts the manifestation of one and the same thought, one and indivisible in its particular character, as is all Thought, as is the Soul itself. Hence comes that agreement of all the proportions, in all that Nature has formed, which constitutes its Harmony, and which Art must before all things observe.

"Let every part of a whole," says LEONARDO, "be proportioned to that whole; if a man is thick and short, let all his limbs be so as well; let him have arms short and thick, hands broad and thick, fingers short, and so of all the rest. And I say this generally for all animals and all plants."*

For things of which Nature offers no model to Art,—for buildings, for example,—there is the same rule, the same law of proportion. "As in an animate being," says LEONE BATTISTA ALBERTI, "limbs should correspond with limbs, so in a building the several parts should answer to each other. Whence comes the rule, that the parts of a large building ought also to be large; a rule which the ancients observed so scrupulously, that, in public edifices of great size, they took care that the very bricks should be larger than in private buildings."† "Let the parts be such," says PALLADIO, in many places, "as to correspond to the whole, and among each other."‡

That is, that, like any living being, a building ought to be, according to the great masters, a whole whose parts tend as well as the entire to one same destination, and consequently to the expression of one single and the same Thought.

Thus, whatever Art creates, for the very reason that its object is to represent Proportions, (which constitute situations and forms,) and to make them understood in their essence and truth, it is not the material of those Proportions which is properly speaking its object, but their Spirit, and it is therefore that the agreement of Proportions or Harmony, the expression of the unity of the Spirit, is the first law of Art.§

Now Art has not for its only object to express the special spirit, the individual and distinctive character of each thing; it has an object yet more elevated, an end still higher.

Whence comes it that situations, forms, Proportions, in one word, interest and please us of themselves, and that Art delights in representing them? It is because by this Harmony, the reflection and sign of the unity of the Spirit, they have Beauty. Beauty,—which is, in the last analysis, that quality of proportions which it is the peculiar office of Art to express. And this is the last reason of the difference we have noted in the beginning between Geometry and the Art of Drawing. "The Mathematics extend only to the knowledge of quantities, but they do not trouble themselves with quality, in which is the beauty of the works of Nature and the ornament of the world."|| Although Mathematics consider Order, Proportion, Size, which are the elements of Beauty,¶ they do not, however, consider Beauty itself, and, on the contrary, Beauty is the true cause for which Art busies itself about what are size, order, and proportion. POUSSIN, also, agreeing with LEONARDO, says: "Painting is more occupied with the idea of the beautiful than with any other. Whence it comes that some have wished that this idea were the sole object and end of all good painters; and that painting which adores and pursues Beauty is the queen of the Art."**

By this alone, that, in all the works of Nature, the Proportions correspond, one with another, and form always some harmony, there can be no work of Nature without some Beauty. Even monsters themselves, thanks to the spirit which has produced and vivified them, are yet in their deformity (as philosophic anatomy has shown them) in agreement with themselves up to a certain point, and up to a certain point, be they ever so ungraceful, still participate in the universal harmony. But just as among Spirits there are some in whose perfection the Superior Spirit from which they draw their origin seems to manifest Himself openly, so also among Forms there are some whose proportions, according to the expression of LEONARDO DA VINCI, appear to be *divine*. These are they which especially and

* *Della Pittura*, p. 191.

† *De Re edificatoria* (Paris, 1512, 4to), f. 12.

‡ *I quattro libri dell' Architettura* (Venez. 1616, fol.), li. 3. Scamozzi, *Dell' Architettura*, P. 1. Bk. 1. c. 26.

§ Leonardo da Vinci, *Della Pittura*, p. 29.

¶ *Della Pittura*, p. 11.

|| Aristotle, *Metaphys.* xiii. 3.

** Poussin, *Osservazioni*, &c.

above all others compose, as he says again, and as is said also by PALLADIO, a harmonic concert; * these are they in one word, which possess Beauty.

As every spirit ascends to the Divine Spirit, so to these divine proportions refer themselves also all the different proportions which Nature displays to us. From the perfect harmony of Divine proportions proceed all the imperfect harmonies, and in Beauty is found, so to speak, the very spirit of so many different spirits.

Whence it follows, to speak definitely, that in order to represent the proportions of things in their truth and essence, it is Beauty which Art must represent.

In not confining itself to the reproduction of the latter of forms and proportions, in expressing their meaning, their character, their especial spirit, Art rises from Imitation to Interpretation. In expressing by means of Beauty the very right of things, it rises still higher again; it no longer proclaims merely what they are, but what they ought to be; it represents, it exhibits what philosophy explains: the cause, the principle.

"Poetry," says a great philosopher, "is a thing more serious and more philosophical than history; for poetry speaks rather the general, history particular things. The general is that which a personage of such a character will probably or necessarily say or do, and this is what poetry represents under proper names; the particular is what a particular person has actually done, or what has happened to him."†

Art, then, is not always, like history, a simple reproduction of the very types which reality presents. It prunes away, it gathers together; but it prunes away always only the accidents which disturb the expression of the thought, of the intention of Nature; it gathers together those things which accidents have divided, and which it is in the spirit of Nature to re-unite. As the philosopher, in presence of the remains of the past, seeks to restore them as they were conceived by their author; so, by modifying the types which reality presents to us, Art but disengages from the obstacles which obscure it the spirit of Nature, and, to express it still better, the Spirit from which it proceeds.

It is always Nature, then, which Art imitates;‡ Nature, such as she shows herself more or less in all her works, and such as everywhere and always she delights to be.

Now, because Art, in its highest sense, in imitating Nature as she ought and desires to be,—that is, in representing her ideal,—does not represent such or such an Individual, with the accidental circumstances which are peculiar to it, but rather the General, does it follow that the ideal is reduced merely, as has been asserted, to the general; that, consequently, Art has nothing to do with individuality, and that individuality ought to be absent in its works?

The Ideal, in every thing, is the general, because it is the type of which the different individuals of the same class offer images more or less like, and which, in consequence, includes all the perfections common to them; but that does not prevent it from being in itself endowed with a perfect individuality. The Ideal in every thing is the type of Perfection; every type of perfection must contain nothing of the incomplete or undetermined. Now all generality is necessarily something of the undetermined and incomplete. In the works of Nature, in particular, the essential is the spirit, the principle and end of all the rest. Now the spirit of a thing is its life, and therefore its individuality itself. How, then, can a general form or rule, exclusive of individuality, be for anything in Nature the true Ideal?

General rules only express the conditions of perfection. The Ideal, very different from these rules, is perfection itself, inseparable from Individuality; that perfection which Nature offers us here and there among her individual creations, and whose first source is the superior Individuality from whence theirs proceed, that, namely, of The Spirit, the universal and supreme ideal.

So it is that the principal object which the true Artist proposes to himself, in realising the ideal, is to offer to us, not the cold personification of abstract rules,

* Leonardo da Vinci, *Della Pittura*, p. 16. Palladio, *Lettera* (Carteggio d'artisti, pubblicato dal Dre. Gaye, Firenze, 8vo, vol. III, p. 398).

† Aristotle, *Poet.* c. 9.

‡ Leonardo da Vinci, *Della Pittura*, p. 6, 7, 8, 14, 90, 204, 205, &c. Poussin, *Osservazioni*, &c. F. Pacheco, *De la Pintura, su antiequidad y grandezas* (Sevilla, 1649, 4to), p. 322.

but, like Nature, whose imitator he is, individualities living and real; and so it is that by the assiduous contemplation of the individual forms created by Nature, penetrated by the spirit of life which animates them, he becomes capable in his turn of animating with his own spirit his own creations;* and it is thus, in fact, that Art was understood and practised by those great masters who knew how, in order to express the various aspects of the universal ideal, to form, out of the elements presented by Nature, characters marked by individuality so vivid,—the Homers, Shakspeares, Phidias, Leonardo da Vinci, Raffaello. And so, very far from works of Art presenting, as has been said,† a character all different from those of Nature, on the contrary, according to all the masters, the last effort of Art ought to be to make Art as it were disappear, and its works seem to be the works of Nature herself.‡

The true proportions of things are the principal object of the Art of Drawing, properly so called, as they are of all the Arts of Design. The superficial images or projections of things, with the perspective diminution of dimensions, with the lights and shades and their melting away, compose the language by which the Art of Drawing, properly so called, expresses and makes intelligible the true proportions of things.

To judge of the geometrical proportions of things, to judge besides of their proportions as they appear to the eye, that is, of the modifications of geometrical proportions in perspective,—such is then, to resume, the double problem which the eye must solve. In what manner, by what course of studies can it most rapidly and most surely be capable of doing so; in other words, by what method can one best and soonest learn to Draw? This is what we now proceed, with the assistance of the principles we have just established, to endeavour to determine.

All the Arts are learned, more or less, by practice. *Fabricando fit faber*, it has been said, and we may likewise say that Drawing is learned by Drawing.

But if it is certain that like all the arts that of Drawing cannot be learned without practice, does practice alone suffice, without any order or any kind of rule? It has been so pretended in our times, and so also even in the time of LEONARDO DA VINCI: "Some believe," says he, "that without other science, the practice of copying natural objects alone suffices." But he adds: "There is nothing which deceives us more than trusting in our own judgment without other reason, as Experience ever proves, the enemy of alchemists, necromancers, and other simple (self-confident) spirits."§

And in fact, how many mistakes of every kind does not practice without any rule, or blind routine, produce, which one must afterwards lose much time to set right? When we walk without guide through an unknown country, on the simple faith of a judgment yet unformed and directed by nothing, how many chances are there of our losing our way! and, what is worse, having had for a long time no means of perceiving in what we are mistaken, how many chances of our contracting, from a false manner of seeing and judging, some irremediable habit! If, then, it is true that Art cannot be learned without practice, it is also true that some Theory is necessary to Practice to direct it.

"Those who are captivated by mere practice without any science, are like navigators who go to sea without rudder or compass, and who never know with certainty where they are going. Practice ought ever to be built on sound theory, without this, nothing is well done, no more in painting than in any other profession."||

* This is what Quatremère de Quincy misunderstands, when he says that Art ought to represent, not a man in particular, but man (*Esquis sur l'imitation dans les beaux-arts*, 1821, in 8vo); a proposition which, understood in the sense he gives it, (after Winckelmann,) supposes the theory, contrary to the opinion of all the great masters, after which, under the usurped name of the *Idéal*, the *Conventional* (whence comes the style termed the *Académical*) becomes the rule of Art.

† See the works of Quatremère de Quincy, Töpffer, &c.

‡ "Soleva dire Michel Agnolo Buonarrotti, quelle sole figure esser buone, delle quali era cavata la fatica, cioè condotte con sì grande arte, che elle parevano cose naturali e non di artificio." Gello, quoted by Mariette in his *Osservazioni sur Couéti*.—Poussin, *Osservazioni*, p. 461: "La struttura o composizione delle parti sia non ricercata studiosamente, non sollecitata, non faticosa, ma similante a naturale."

§ *Della Pittura*, p. 556.

|| *Della Pittura*, p. 69.

It is evident, in the first place, that among all the objects which can be studied, there are some the study of which is more profitable; at least, one of the first rules by which practice ought to be governed, is that which will teach it to what objects it should by preference address itself.

Of all that Nature produces or Art has ever invented, the human figure is that which it is most important to understand well and to know how best to represent, because in Art as in Nature it is to Man that the first and principal place appertains. Made, among all bodies, to serve for the habitation and instrument of the Soul, to obey its will and to express its affections, the Human Body is of all that which, in its movements, in its forms, in all their proportions, presents at once the greatest variety and the greatest unity; it is that whose different types are the most strongly marked with a special character, a distinct individuality, that, in fine, which is susceptible of the greatest Beauty. From this it results that errors in the representation of the human figure are more sensible than in that of any other figure, and that he that commits them recognises them himself more easily. From hence it follows that to teach how in all things to judge of their proportions accurately, that is to say, as we have said, to Draw, there is nothing better than to propose, as the first object of study and imitation, the human figure. It is a point upon which scarcely any difference of opinion exists.

But because the human figure is the most complicated both in its movements and in its forms, it follows also that it is of all figures the most difficult to see well and to represent well. In living nature, where to the variety of forms is added that of colours, and the mobility inseparable from life, the complexity is such that it is manifestly impossible for a beginner not to lose himself in it. Hence the necessity, upon which all the world, or all but all, is again unanimous, of a simplification at first, of that which consists in giving as a model not nature itself, but an image of nature, without motion and without colour; that is what is ordinarily called a *bosse* [a statue, cast, or figure in full relief].

But does not such a figure, if it be an entire figure, offer still a whole composed of too many different elements, whose relations it is impossible for an inexperienced eye to seize and reproduce? Upon this point again, upon the impossibility of giving to the beginner an entire figure for model, no difference of opinion.

Now, there is one part of the human figure in which, more even than in the remainder, the proportions are skilful and delicate, which more than all the rest possesses individuality of character, which, in fine, is susceptible of a beauty more exquisite than all the rest, and which besides forms in itself in some sort a whole, already sufficiently complicated and difficult to understand. This part is the Head.

The least simplification which it would be necessary to make, the least restriction to the hazardous essays of a blind routine, would be to give at first as models only round casts (*bosses*), and among these only those of simple Heads.

Must we not go yet further? Must we not give beginners for their first models, instead of round casts, prints, drawings, or photographs, where the visible appearances are more easily distinguished from the real proportions which they express, where the lights and shades are more simple and more easily understood; must we not also, instead of entire heads, make them imitate at first only the parts of which the head is composed? It is this opinion which in all times has obtained greatest credit; it is this which in all times has been generally practised, as witness the writings of CENNINI,* LEONARDO DA VINCI,† BENVENUTO CELLINI,‡ VASARI,§ LONCAZZO,|| ARNENINI,¶ DE PILES,** &c., as prove the collections of the *Principles of Drawing* which have been published at different epochs.†† In fine, it is this which is practised still in our own times in the greater part of the schools, one may even say in almost all.

From all time then this principle has been generally held as true; that it is

* *Trattato della Pittura* (Roma, 1821, 8vo), c. 8.

† *Della Pittura*, p. 57.

‡ *D'acordo sopra i principi et modo d'imparare l'arte del disegno* (ojere, Milano, 1811, 8vo, vol. III.)

§ *Introduzione alle tre arti di disegno*, c. 15. *Vita di Michelangelo Buonarroti*, p. 129.

|| *Trattato della Pittura*. ¶ *Preceiti della Pittura*, c. 5. ** *Elements de peinture pratique*, P. I. c. 1.

†† See especially those engraved after the designs of Palma the younger, of Prospero Fontana, of Annibal Carracci, of Guercino, &c.

only after having learned what is easy and simple that what is difficult and complex should be attempted. On this principle the student imitates drawn or engraved figures before those in relief; the parts of a figure before the entire. Moreover, he applies himself to imitate exactly the form of whatever subject he studies, and consequently to represent with care the lights and shades which render it visible, and which determine the relative inclinations, the melting away or the relief of the surfaces.

It is complained that by this method, proceeding step by step from the imitation of the several parts of the head, after prints, too much time is required to come to the imitation of heads and entire figures from the round; it is also complained that too much time again is spent in making each drawing in the imitation of the lights, of the shadows, of the half tints; that amidst the minutiae of this labour a vicious habit is contracted of pre-occupying one's-self to excess with details,—a habit which no longer allows one to comprehend the effect of the whole. It has been said, in short, that the result which we ought to propose to ourselves is that of leading the student, in the least possible time, to reproduce the effect of the whole and the general aspect of things, and that after several years even employed in this patient study, beginning with the elements of the human figure, one can scarcely hope to reach such a result.

Hence the different systems in which Drawing is commenced by the imitation of heads in full relief.

In the boldest of these systems such models are given to the student for imitation from the very first, and without assistance. This is what JACOTOT, the author of what is called the "Universal" system, proposed as an application of his general views towards the simplification of instruction. Experience has proved, as it was easy to foresee, that a head in full relief,—that of the Apollo Belvedere, for example,—proposed as a first model to all beginners, offers them, by its multiplied proportions, complicated by so many mysterious effects of perspective and light and shade, absolutely insurmountable difficulties; they either lose courage entirely, or else, passing on to another work, in spite of the gravest errors, which they are utterly unable to correct, they take up for ever the ruinous habit of doing bad work and remaining content with it.

In the system proposed by M. ALEXANDRE DUPUIS, more than twenty years ago, a system which has gained considerable support, and which even now has its partisans, the first model proposed for imitation is still a head in full relief, but it is a head simplified.

By this means M. DUPUIS has hoped to preserve the advantages which JACOTOT promised himself by his plan, and to get rid of its inconveniences.

Accordingly, M. DUPUIS gives beginners for their first model a bust which presents only very general masses or features; after this bust, another, which offers some additional indications of the head; then a third, in which the details are still more numerous and more decided; and lastly, a fourth, which completes the series, and which alone is all but according to nature. These four busts (of which each is, besides, placed in three different positions: the head set straight in the first, raised in the second, but down in the third), these four busts thus present four successive states of the same figure, from the roughest sketch up to the completion of it; they are the degrees by which the author of the system proposes to conduct the student, from the general indication of the whole to complete representation, comprising all the detail of the parts.

So that, says M. Dupuis, while commencing Drawing by the entire Head, by a whole, as in M. Jacotot's method, and in all the methods by which it has been sought to abridge the study of Drawing, we commence, however, by a simple and easy object, and only pass in succession, as in the ordinary method, though following indeed an inverse path, from the simple to the complex and from the easy to the difficult. Besides, thinks he again, to proceed thus is to proceed in conformity with the great principle, that general effect should command the details, and that, accordingly, every work of art should commence by the general effect of the whole.*

* *De l'enseignement du Dessin sous le point de vue industriel*, par Alexandre Dupuis (Paris, 1836, 8vo), p. 29, et seq.

In truth, if the different parts may be called simple in relation to a quality, and it is in this sense that the limbs are simple in relation to the body, we may from another point of view consider as simple, in relation to an object completely determined, a less determined state or condition of that same object, and one which consequently presents less complexity; and it is in this sense that the rough sketch of a figure, in which as yet the individual features find no place, is more simple than the finished figure. Now this previous and simpler state is often called, elliptically, the whole; elliptically, for it is not the whole with all the parts composing it once realized, and which themselves in reality form a whole; it is the whole without its parts, the general effect abstracted from the details, or, if you please, the general effect comprehending the details in a manner purely virtual and ideal.

But the character of this whole abstracted from its parts is: to be, in relation to the real whole of which it is the sketch, still undetermined, indefinite. Hence it follows that, for him who does not know the details which the abstract whole in its general effect comprehends but virtually, this whole has but an undetermined meaning; and an undetermined meaning is not one at all. To give a beginner such a whole is then to propose to him a model which for him is meaningless. Such a model has, consequently, nothing in it proper to teach the imitator of it exactness and precision, and—the habit once engendered at starting of doing nothing save roughly, and then only almost doing it—when the student gradually arrives at details he will be able but roughly and only almost to comprehend and represent them.

Doubtless whatever one desires to do it is the general effect, it is the whole, the whole without the details of the parts, which must first be established; for it is this whole, in which the parts will successively take their proper places, which must first be correct, and the happiest details cannot compensate for errors in it; this is what LEONARDO DA VINCI incessantly advises Artists not to lose sight of.*

It is, in fine, a truth with which the Greeks particularly showed themselves profoundly penetrated; for if there is one quality above all by which their works most surpass those of the moderns, it is in the understanding of the general effect. But it is not less true that this general effect of the whole without parts, by which everything to be done must necessarily be commenced, has no meaning, save by relation, to the complete whole, of which it is the preparation and first stage. For the artist who indicates it and who knows what he must add to it, this first general effect (*ensemble*) has then a definite sense, and from this it follows inevitably that the sketches of a master, even the most summary, instead of being confined to a generality systematically shapeless, always here and there let out the determinate, precise, and well defined ideas of which they are the design. But those indications themselves, to an inexperienced eye, are but enigmas. The sketch, in fact, has a meaning only for its author, and for those whom experience and science have put in a condition to share his thought, and to anticipate with him its realization. For a beginner it has no meaning, or only a vague and confused one. To propose it to him for imitation at starting is then, once more, to give him for his first lesson to content himself with an ill defined meaning; it is to make him contract the habit of doing so; it is to deprive him, by such a habit, of the desire, and soon even of the power, to reach as to any object whatever the definite and determined, that is, the reality. From which it is evident that, while in everything it is by a sketch that what is desired to be done must be commenced, it by no means follows, as M. Dupuis has thought, that the first models should be sketches. Far from this, to habituate one's-self from the start to imitate objects systematically undecided and shapeless is to render one's-self incapable of ever understanding the real forms, and therefore of ever being able to make a simple sketch, such at least as those which come from the hand of a master, and in which, little as there may be, or be seen in them, at least what ought to be is already distinguishable.

However, it must be agreed that the models proposed by M. Dupuis do not present that appearance of vagueness, which is in general the character of mere

* *Della Pittura*, p. 58, 72.

sketches; this arises from their being fashioned out by planes and by angles. The first of these models presents but the great masses thus indicated; the second only differs from the first, and the third from the second, by the planes and angles being more numerous; and even the last, which approaches nearest to the forms of nature, still retains much of this same character. In this above all, these models differ essentially from the works of a master's hand, and they resemble more closely the successive stages by which the workman or stonemason mechanically nears by little and little the shape of the marble or the model, which the artist has charged him to reproduce.

The object of the constant reflection of the Masters, the end to which they ever look, being, as we have said, the expression of the character or soul of forms, their constant practice has been to indicate it from the very first, even in the lightest and most fugitive sketch, and accordingly, in sketching the figure of a living being, and above all the human figure, from the very first to make felt the nature of those sinuous curves or *serpentine*s, (as LEONARDO and MICHELANGELO called them,)* which are its peculiar characteristics, and which reveal its spirit. This is what we see in the drawings of Titian and of Correggio, as well as those of Raffaele, of Leonardo da Vinci, of Fra Bartolommeo, and of Michelangelo, as well as in the sketches in wax,† and in clay, or even in marble,‡ which remain to us of this great artist.

An entirely different manner has begun to reign in certain schools in the 17th and 18th centuries,§ according as the true sentiment of the spirit of forms became more weak; it is that which consists in replacing curved lines and surfaces by straight lines and planes; confined at first to the detail of figures, to the smallest parts composing them, this process has been more and more applied to the larger parts, and finally, in our own time, among many draughtsmen and painters, it has extended itself to every branch of Drawing.

The models proposed by M. Dupuis present a systematic application of this process, one of which beginners who copy from them must necessarily contract the habit.

Now, in the first place, habituated to see every thing under one sole aspect, the eye must by little and little become incapable of understanding the infinite variety which nature offers us; it must become incapable, above all, of understanding, and of representing those subtle and winding forms which are the distinguishing characteristics of human nature, those forms which Michelangelo compared to the waving motion of a flame.|| In the second place, the particular effect of this process which consists in expressing every thing, or almost every thing by planes, is to disguise under the precision of surfaces so regular, the actual indetermination of forms, and so to give to the unskilfulness of him who does not know how to distinguish, and to reproduce the true character, a false air of knowledge. Thus the inconveniences of this method are aggravated.

If by adopting the habit of copying simple sketches, such as (once more) the sketches of the Masters, we can express nothing but in the rough, and only half express it even so, if in consequence we do not reach the truth at all, we are in this, properly speaking, engaged in the false, and the very indetermination at which we stop short, might warn us that to reach our end, a part of the road remains to be traversed. But if we adopt in addition a manner of work which gives to every thing we do a semblance of precision and perfect definiteness, we conceal from ourselves our weakness or our ignorance, and we set a bound to our own progress almost impossible to pass over.

M. Dupuis' method was conceived for the purpose of teaching the art of Drawing to the working classes; to those classes who have need of an elementary knowledge of Drawing, in the exercise of a multitude of professions, more or less mechanical, and who can devote but little time to acquire it; and it seems sufficiently appropriate for this purpose. If, in fact, it follows from what we have

* Leonardo da Vinci, *della Pittura*, p. 89.—Lomazzo, *Trattato*, &c., l. vi., c. 4.

† See those in the possession of M. Gherardini, of Florence, and which are at present in Paris.

‡ See the two Slaves, in the Musée of the Louvre (Paris); the Saint Matthew, of the Academy of Fine Arts, at Florence; the Madonna, and the Day of the chapel of the Medici.

§ It was already known before, and Lomazzo calls it *quadratura* (*Idea del tempio della Pittura*, c. 4.)

|| Lomazzo, *Trattato*, &c., l. i., c. 1.

said, that this method cannot lead very far, on the other hand, it is undeniable, that in making the student begin by the imitation of simple wholes, it is, perhaps, fitted more rapidly than any other, to put him in a condition to seize the general effects of proportions, and to put the principal masses almost in their proper places; and if it is not enough for Art, it is enough for what of knowledge of Drawing most trades require.

This method, once more, may then answer sufficiently well for the instruction of the artisans for whom it has been designed, but that is no reason why it should be introduced, as some have desired it should, from these popular schools where it is said to have done good service, into the schools of a superior class, and above all into the *Lycées* [Colleges, or Collegiate Schools].

However, if it be a method by which we can indeed acquire more rapidly than by another, a certain knowledge of Drawing, however limited, perhaps we should be tempted to believe, that it ought to be adopted in preference by all our schools, except those especially destined for the formation of Artists. Everywhere, some will perhaps say, it is for the greatest number, and especially for them, that we should chiefly be concerned; now the greatest number has need of knowledge of Drawing only of a very elementary kind, so far as it is required, not for the practice of the Art, but for the different industrial pursuits with which Drawing has something to do. What is of the greatest importance is this, that those very persons who can devote but few years to general study, and to that of Drawing in particular, should be able in those few years to learn as much of it as is necessary for representing with some accuracy the situations and dimensions of things; and if it be a method by whose employment such a result can be reached, even if it cannot serve, nay, even if to a certain point it interposes an obstacle to further progress, this imperfect but expeditious method must still be preferred.

We cannot share in such a view.

Even admitting what is far from being incontestable, that for the practice of the different branches of Industry, there is never any need of drawing with the same precision, and the same delicacy, with which artists must know how to work, it is still one of the first interests of industry, and consequently of the great number who are engaged in it, that Art should not decline in the hands of those at least who practise Art. It is from Art that all the branches of Industry which have any relations with it, receive their inspirations. It is Art which supplies them with the types which they multiply, in accommodating them to our different wants, or to our different fancies. All are constantly occupied in appropriating to everything that surrounds us, the forms with which the imagination is captivated, and of which that Art which reigns at each epoch is the source; all profit by the power of seduction which Art exercises, and by the favour which attaches itself to every thing that bears its mark.

When a great master appears, and comes to show all things under an aspect till then unknown, for such is the privilege of genius, all that is subject to the power of man, must put on those proportions, those new harmonies which he is come to reveal. Thus to spread and to apply its thought in every form, the ancient arts are transformed and regenerated, and new arts take birth. And to this immense work come together, yet from afar off, to furnish its materials, even the very branches of industry, which seem the most foreign to the Art of Drawing. Who can say what even the most mechanical professions owe to the genius of a Raffaele: not only the art of Marc Antonio, not alone that of the potters of Faenza, of Gubbio, of Pesaro, and of Urbino, not alone the fabrics of the tapestry works of Flanders, and the enamels of Limoges, which have reproduced his creations under so many forms, but all the industries of his age, and of the ages which followed his; how many men have lived on the fruits of his thoughts, and of what riches of every kind it has been the source? Who can calculate what for three thousand years, one half the universe owes to that Greek Art, from which even still, though modified by so many different influences, not only the forms of all our public works, but those even of our vessels and commonest utensils are derived?

And as for the industry of France in particular, if it be by so many titles in the first rank among the industries of Europe, to what is this due, if not to

this, that the first rank already for a long time belongs to our painters and our sculptors, and that in Art, no more than in Literature, no nation can dispute it with her?

What worse service then would it be possible to render to the greater number in every country, but above all in ours of France, than to put everywhere in force methods of instruction calculated to set bounds, even to the measure of mediocrity, to the development of talent, and by an ignorant zeal for the crowd, to arrest the flight of those men of rare genius, (*génies d'élite*) which it ever conceals in its bosom, and whom Providence destined to be its benefactors?

Will it be said, that rare Genius knows how to burst its way, whatever difficulty it encounters, and that it is useless to take special care of it? Examples abound in history, and in the history of Art in particular, of men of genius happily endowed, whose career has been falsified, and destiny destroyed by a bad education.

In the second place, and supposing even that one should not occupy one's-self with this small number, with this *élite* which will practise Art with success, and spread its benefits over the crowd, nor even with those already more numerous, to whom it would be useful, in the career which they have to pass through, to possess the knowledge of Drawing to a somewhat high degree, it is certainly important that among the greatest possible number taste should be healthy and good. And so, if the state of Art, and consequently of all the industries which depend on Art, depends upon the genius and education of artists, it depends also, in very great part, on the judgment of the public, which, by its approbation or disapprobation, may sustain the artists in such and such a course, or turn them from it. Now, as PAUL VERONESE said, "those alone can form a good judgment upon matters of Art, who have been well instructed in Art."* Accordingly, since Taste is the just appreciation of the beautiful, since between the beautiful, the true, and the good, there is a close connection, and so to speak, an intimate solidarity, what interest is more general, than that to direct instruction in Drawing, in such a manner as to give as much as possible to all those who take part in it, a just and delicate taste, a sure discernment of beauty? If that is true for all the schools, for how much stronger a reason is it not true for the schools of secondary education, and where those are educated, who by their lights, as well as by the place which they will occupy in our society, are destined to exert the most powerful influence upon the spirit of their time?

For these different reasons, we cannot recommend the establishment in our *Lycées* of any of those expeditious methods which lead, however ingenious they may be, but to an inexact and erroneous appreciation of forms, and their character. The only method which we can propose for the approbation of the Minister, must be that method which will lead, though at the price of a little more time and trouble, to the end of Instruction in Drawing, such as we have been able to define it, after the great Masters of Art: the possession of that good judgment of the eye, by which men appreciate proportions correctly, and understand their spirit and beauty.

We have seen that the human head is an object too complex to serve for a first model for the student, that in seeking from the start to imitate its forms, the beginner can but contract a habit of error; we have seen also, that to propose for a first model, a whole in an abstract form, and without parts, is again to teach, though in another fashion, but error and confusion.

Hence, we are of necessity brought back to the method which has almost always prevailed, and which confirms the authority of all the masters of Art, that which only allows the whole to be studied, after a profound study of its parts.

"The sight," says LEONARDO DA VINCI, "has an action of the quickest, and embraces in one moment an infinity of forms, nevertheless, it only comprehends one thing at a time. Let us suppose, reader, that you bestow one rapid glance on all this written page, you will judge in an instant, that it is full of different letters; but you will not know in so short a space of time, what letters they are, nor what they mean; you will be obliged then to go over them word by word,

* Bartol: dal Pazo, *le vite de pittori, de gli scultori et architetti Veronesi*, Verona, 1778, 4to, p. 113.

"line by line, in order to comprehend those letters. Or again, if you wish to reach the top of a building, you must mount up from step to step; without which it is impossible for you to reach the top. And so it is, I say to you, that Nature regards this Art of Drawing. If you wish to have the true knowledge of the forms of things, you will commence by their parts, and you will not pass on to the second, before you have the first well in your memory and in your practice. And if you do otherwise, you will lose your time, or at least, you will prolong your study. I repeat to you once again, learn accuracy before rapidity."

But, it is said, on the other hand, if we cannot begin with the Whole, why not descend to details still smaller than those by which one generally commences, why not descend to the fingers, to the nails themselves.

It is, because, in recommending not to begin with the entire of a visible natural object, nor even by a whole, such as the human head, too complicated still, although this too is but a fragment of a whole, nevertheless for an inexperienced eye, in order to satisfy the two principles equally certain as they are that we cannot commence with a very complicated whole, and that only a whole can make itself understood, reason requires that we should commence with parts, which, though parts, yet form wholes in a sense in themselves, and are in consequence intelligible objects. We will stop then, as men have always done, at those fragments which have to a certain extent a special destination, a special character, a distinct individuality, such are the eye, the ear, the mouth, the hand, &c. Sufficiently simple not to surpass the comprehension of a beginner, every such part is already a whole in itself, in right of this quality, and like a whole, each such part may be understood by itself alone. As parts of a Whole more complicated, they cannot, it is true, be understood without that whole. It is then by arriving at that Whole in which they act one with another, and where they harmonize together, that—after having studied each part separately—they can all be understood.

After having taken as a base of operations, as we do in every science, that which is less intelligible in itself, but more accessible, it is in the last place, according to the order which befits our weakness, and which is recommended by wisdom, that we raise ourselves to the culminating point of complete science, which is like an elevated pinnacle, whence we can embrace all, and understand all.

Lastly, to leave from the very start, only so much obscurity around the meaning of the several parts of the human figure, as the time is not yet come to clear away, we should not neglect to make beginners see from the first, in a general way, the relations they bear to the whole, and the position which belongs to them. It is also thus, that in every science a general and preliminary exposition precedes instruction in detail, and prepares the way for that last and philosophical exposition, in which the details reunited and arranged in the Whole, will receive their last and full explanation.

Such is then the order which theory prescribes to the practical study of drawing. But the determination of this order, is this the only share which theory should have in instruction? And accordingly, the order of practical study once determined, is it enough for the learning of the elements of Drawing, that this study should consist in commencing with the imitation of the parts of the head, and finishing with that of the entire figure?

[After having demonstrated (continues the Editor of the *Bulletin*.) by the reasoning and by the authority of Leonardo da Vinci, of Michelangelo, of the artists of antiquity, &c. the necessity of the study of the anatomy of the bones and muscles, and that of the proportions, M. F. RAVAISSON proceeds as follows:—]

In fine, we have seen above that Drawing is properly speaking the representation of the proportions of things as they appear to the eye. We have also seen, that if we can hardly well judge of the reality by the visible appearance, which is for us its sign, we can hardly see the appearance either as it is. Hence, constant difficulties, as well when we invent, to give to the things we imagine the forms they ought to have, as when we imitate, to judge accurately of the appearances of things, and to reproduce them faithfully. Hence an uncertainty from which we can scarcely escape without many errors.

Now the relation between visible appearances and actual proportions, for any point of view and any distance, is regulated by geometrical laws; by these laws, which are those of perspective, we can with certainty anticipate experience, and without error, destroy the appearance of the reality, or the reality of the appearance. Who then can doubt that the knowledge of it would be most useful to assure the judgment of the eye, and to protect it from error? And so, at the era at which the art of Drawing among the moderns has attained the highest point of perfection, we see perspective held in honour.

After Brunelleschi, Paolo Ucello, Lorenzo Ghiberti, who were the first to understand well its rules;* after Pietro della Francesca, who was, it is said, the first to give the theory of it,† the masters whose works adorn the middle and second half of the 15th century, Masaccio, Filippino Lippi, Pisanello, Signorelli, the precursor of Michelangelo, Melazzo de Forlì,‡ whose frescoes probably taught Correggio the art of backgrounds, (sotto in su) Vincenzo Foppa, the two Bellini, Mantegna, Ghirlandajo, Perugino, showed themselves consummate in the new science; Leonardo da Vinci made it the subject of a book, now lost, which became the source of the principal works in which it was treated in the 16th century; Raffaello, in fine, to whom Perugino had taught it, knew it so well as to give lessons to the great Florentine painter, Fra Bartolommeo. And we cannot doubt, that the knowledge and habitual practice of perspective, effectually contributed to give to the art of Drawing, among the painters of the golden age of Art, much of that exquisite accuracy, and accordingly, that finished elegance, from which men subsequently receded more and more, according as counting more for the concealment of mistakes on the play of light and shade, and the effect of aerial perspective, men trusted more and more to the unassisted judgment of the eye.§

It is not that when we learn to draw, we must frequently put in practice the rules of perspective, to find the place and dimensions of outlines and shadows. We have already said, that to construct forms by geometrical rule, is no longer to draw, but to trace them, and consequently, it cannot teach us to draw. But at the same time that it furnishes us with an exact means of geometrical construction and verification, the knowledge of the principles of perspective, united to the habit of applying them, must necessarily, in making us attentive to the perspective diminutions of proportions, and the laws which they follow, lead us to observe them better, to appreciate them, and to represent them more justly.

Now if the knowledge of perspective serves to make us judge well of all visible forms, of those of the bones and muscles, as well as those of the exterior surface, does it not follow, that it is with perspective that instruction in Drawing ought to commence? Practice should be founded on good theory, of which perspective is the entrance and the guide.||

Will it be objected that it prolongs too much the teaching of Drawing, to join with it that of perspective, as well as the structure and proportions of the human figure? Very far from this, these are ideas which at the same time that they must throw light on practice, and so render its progress more rapid as well as more sure, may be acquired in a time relatively very short. These principles, says LEONARDO DA VINCI, who continually recommends us to begin with the study of the scientific principles of Art, these principles are but a little thing near Art itself.¶

To learn in the first place, perspective; in the second place, the structure of man and his proportions; in the third place, only to draw the human figure; first, the several parts, and then the whole; such then is the order prescribed by

* Van Eyck was also perfect master of geometry and perspective, as Bartolommeo Gatto affirms in his eulogium on him, and as his pictures prove.

† Besides the life of this master by Vasari, see Luca Pacioli, *de divina proportionibus*, (Venet., 1509, fo.), ff. 23 and 33.

‡ See Luca Pacioli, *summa de arithmetica, prax. and de divina proportionibus*, f. 18.

§ Of so many other masters, subsequent to those just named, and who were thoroughly masters of perspective, we only name Giallo Romano, Jean Gonjon, Jean Cousin, Barocci, Cigoli, (who has left a valuable treatise on this science,) Fabio Cespeda, Lodovico, Agostino, and Annibale Carracci, and Poussin.

|| Leonardo da Vinci, *Della Pittura*, p. 69.

¶ *Della Pittura*, p. 33.

LEONARDO DA VINCI for the study of Drawing*, and which has not ceased to be the order most profitable to follow.

This does not, however, prevent the teaching of the scientific principles of Art from being usefully preceded by a certain number of lessons, consecrated to purely practical exercises, exercises which may consist of the imitation of simple figures, such as those of regular solids, of some parts of vegetables, &c. In these first essays, we would accustom ourselves to draw the outlines, to indicate the shadows; we would accustom ourselves above all to observe proportions and forms, and the very difficulties themselves which we should experience in judging of them accurately, and reproducing them well, would dispose us to recognize the necessity, and to comprehend the use of those principles, whose methodical application will serve in the regular course of instruction, to resolve successively the various problems of Drawing† These different exercises would thus form a sort of preparation for the regular course of studies, which would commence with perspective.

In our schools, (*lycées*) where for every reason the instruction must be but very elementary, the study of perspective will be necessarily confined to general principles, and to the applications most useful for the practice of Drawing. Care should be taken above all to explain how this science, which is at present scarcely applied save to the foreshortening of regular forms, which can be geometrically drawn such as those of a building, may be applied alike to every kind of forms and particularly to the human figure.

The study of measures (and proportions) should extend only to those which it is most important to know, and which are the most constant; and the master should apply himself to explain by examples chiefly borrowed from the *chefs-d'œuvre* of antique art, how the infinite variety of individual forms reconciles itself with the general rule, which is the law of species. The study of the anatomical structure also should be limited to what it is most necessary to know, and what may be learned from casts, prints, or photographs, upon the situation and functions of the muscles and bones.

But, on the other hand, it would not be enough for the scientific principles of Art, that some lessons more or less abstract should precede the practice. In Art, practice is the end, theory is one of the means of reaching it. From the start, theory ought then to be accommodated to practical use, and practice ought to the end be enlightened by theory, and incessantly take counsel of it.

Consequently, when the principles of perspective are explained to the Students in our schools, care should be taken to make them sensibly understand those principles, by exhibiting to them, and causing them to make for themselves immediate applications to objects analogous to those which a little later they will have to draw. And on the other hand during the course of practical study, and throughout its whole continuance, no occasion should be neglected to make them see how the problems offered to the eye by the foreshortenings, implied by relief, in every object of nature, all range themselves under the general laws of perspective, and how it leads to resolve them. It is thus that throughout all instruction in Drawing, the maxim is verified, that "Perspective is the bridle and helm of painting."<‡

In the same manner, in giving the necessary instructions upon the anatomical structure of Man, as applied to the Art of Drawing, and upon his chief proportions, care should be taken to make it clear from the very first by examples of its practical usefulness. Afterwards, as fast and according as the student is made to draw the different parts of the human figure, or even entire figures in different movements and attitudes, he should be made to study it anew, more deeply, and in greater detail, and as well structure as proportions. For this purpose no mode perhaps is better than that proposed by Alessandro Allori,§ and which was but the application to Instruction in Drawing of the ordinary manner of proceeding

* *Della Pittura*, p. 501.

† See on this point, the judicious reflections of Sir Josh. Reynolds, *Annotations to the Art of Painting*, of C. A. Du Fresnoy, York, 1783, 4to., p. 70.

‡ Leonardo da Vinci, *Della Pittura*, p. 254: *La prospettiva è briglia e timone della pittura*.

§ Baldinucci, *Vita di Alessandro Allori*.

adopted by Michaelangelo; * a mode which consists of either before making the student draw each part of the body as it is in outward form, to make him first draw the bone which it includes, and then the muscles or cartilages which are covered by the skin; or at least occasionally, to place by the side of the models after which the superficial figures of the objects are to be reproduced, the representation of their anatomical structure, a representation which in part explains their appearances, and which thus leads the student, as in other respects the knowledge of the laws of perspective leads him, to understand them better, and therefore to draw them better.

In anticipating experience, according to an expression we have borrowed from Leibnitz, science reduces the probabilities of error, which experience always allows, and lets none of them exist, as has been said also of wisdom in respect of chance, save what cannot be taken away. This is also what the previous study of the Parts does in regard to the study of the Whole. The parts once well known in their constituent elements, in the chief varieties of form and under the different aspects which they can present, when we come to the whole we half know it already, and familiarized with elements analogous to those of which it is composed we understand it better and represent it better. It is therefore, as we have said, that the parts must be studied before the whole; it is therefore also that there is no use in studying them unless we study them profoundly, so as to know them well, and that, consequently, "we must not pass from a first to a second unless we are in possession of the first." †

From this, several practical consequences follow. In the first place, the parts of the human figure ought to be, in general, as well in models as in the copies which the students are caused to make, of equal dimensions with nature, or at least very nearly so; for in objects of small size one is more exposed to miss seeing all, and for the same reason, "in little things one does not see his own faults as he does in greater." ‡—Once master of the detail of the parts, we may, on the other hand, when we come to draw entire figures, give them, without any inconvenience, smaller dimensions. In drawing such figures, in order that we may keep the different parts of the copy we are making in proportion one with another, we must embrace the whole of it at a single glance; and the custom has very reasonably grown to be not to give the drawing of the entire figure dimensions greater than those of an ordinary sheet of drawing paper. There is something more; these dimensions are those ordinarily given to the models themselves; now, since we learn to draw only by the judgment which we apply to the relations of dimensions or Proportions, and as, consequently, it is important that beginners should not be able to contract the habit of taking measures on the model to dispense with that judgment, it is a useful thing to practise them in giving to their drawings, representing entire figures, dimensions different from those of the models from which they copy. It will then be proper, if the models in general are only of the size of an entire sheet of paper, to make copies from them occasionally of a smaller size. But for this reason, that in little things one cannot well judge of his own faults, and that the student may not become accustomed to content himself with inexact imitations; the dimensions of drawings of entire figures ought not, in any case, to sink lower than those of a half sheet of drawing paper.

In the second place, objects are only well distinguished by their lights and shades, which render sensible their relief. If the line which marks the extreme limits be sufficient to represent the figure on a smaller scale, and to secure its recognition, it is but by the lights and shades presented by its surface that we can

* Mariette, *Observations sur la vie de Michel-Ange écrite par le Conditi*, § 45:—"We hardly see any other painters who draw in Michaelangelo's manner, as we see no more who study anatomy as he did. When he had to make a figure, he began by establishing the skeleton, that is, he drew the bones of the skeleton, and when he had satisfied himself of the situation which the movements of the figure caused the principal bones to take, then he began to clothe them with their muscles, and afterwards again he covered the muscles with flesh. And let it not be said that what I here assert is a mere fiction or figure of speech; I am in a condition to prove it literally: I have many studies of Michaelangelo for his statue of Christ, (of the Minerva) in which we can follow him in all his operations." Many of the models in wax belonging to M. Gherardini, of Florence, and of which I [M. Ravaissou] have spoken above, are examples of this method.

† Leonardo da Vinci, *Della Pittura*, p. 51.

‡ *Della Pittura*, p. 51.

understand exactly and completely its proportions, its character, and its special beauty. In order to fulfil the precept according to which, in all the course of his studies, the student must not pass from one object to another until he understands the first well, it is therefore necessary that in respect of every object he draws, from the most simple parts to the most complicated whole, he should not confine himself to a line, nor even to a rough indication of the model, but he must apply himself to reproduce, and to reproduce exactly, the lights and shades.

"If you wish, oh draughtsman," says LEONARDO DA VINCI, "to make a good and useful study, judge well among the lights which are those, and in what number, which possess the first degree of brightness, and so among the shades which are those which are darker than the others, and in what manner they mingle together, and compare these always one with another; and lastly, let your shades and lights be joined without lines or points, and mix with each other like smoke. And when you shall have brought your hand and your judgment to this amount of exactness, the practice of drawing will come to you so fast that you will not even be conscious of it."*

To express the exact character of the shadows with the same pencil which serves to mark the outline, to render it with softness, and, according to the Italian expression, *sfumato*, by parallel, or crossed shading, great labour is required, which occupies much time. With a stump both the shadows, and the passage of the shadows into the lights, can be imitated both more easily and more quickly. It would seem then, and it has been proposed, to prescribe the use of the stump rather than that of the pencil for the imitation of the shadows.

The Commission is nevertheless of opinion that for teaching, and in order to form the eye to judge well of forms and their character, the pencil is preferable to the stump. The pencil represents shadows by simple lines. These lines, according to the direction in which they are traced, may contradict the forms whose relief they should serve to express, or, on the contrary, by conforming themselves to these, may assist, by their very direction, in making them better understood. To put in the shadows with the pencil, the general effect and the details of the forms must be then observed every instant, as well as the changes which they undergo by foreshortening.† Each line, each shading becomes thus a teacher of the character of things, of their anatomical construction, and of their perspective. This is what we are shown by the drawings of the best painters, and the prints of the best engravers, with whom to put in the shades is never anything else than to draw. Moreover, we have not stumps always by us; and on the other hand we have always at hand a pencil, or a pen, or something which can take its place and perform the same office. It is important, on principle, to learn to make use above all things of those means which are least likely to fail us, and to know how, in short, to paint the shadows with the same point which serves to make the outline.

If then the use of the stump may occasionally be permitted, if it be even useful to learn in good time to manage it, were it but to make one independent of every process and special mode of working, still the habitual instrument, and especially at the start, should be the pencil.

From all that precedes, it follows that the object we should propose to ourselves in indicating the shadows is, not so much to please the ignorant or ill-taught eye, by the regularity of the work, as to express in a manner as perfect as possible the figure and character of the objects drawn. In this manner, by devoting to the study of the model and to the light and shade all the necessary time, the greatest part of the course will not be taken up, as often happens, in the minute imitation of the works of engravers. Besides, once that we have become, by sufficient practice, able to express the half tints completely, in the absence of which the lights and shadows do not possess their true character, but which form the most difficult part of the study of the model, and that which requires the longest

* *Della Pittura*, p. 63.

† Leonardi da Vinci, *Della Pittura*, p. 64.—Monge *Geometrie descriptive*, ed. 1811, p. 162:—"For every object, and for every portion of the surface of an object, there are particular outlines, and particular shadings [*hachures*, small lines employed in shading] more fit than any others to give an idea of the curvature of the surface, &c."

application, we can, without omitting them, spare ourselves, nevertheless, the time necessary to represent them well with the pencil. For this it will be sufficient to draw on a ground by whose tint they are supplied. This is what was done in the best times of Art, by using for drawing paper, paper slightly coloured, upon which the shadows were indicated in black, and the brighter lights in white. And according to Leonardo da Vinci, who managed the pencil as well as the pen with astonishing dexterity, this is in fact the best method to draw from models in relief.*

We have seen that it is by the separate parts of the human figure, and not by the whole, that a beginning should be made, and for this reason, that in all things the path which ought to be chosen is that which leads from the simple to the complicated. For the same reason, the first models should not be reliefs, (round figures,) but imitations of relief in the flat. "Begin," says LEONARDO DA VINCI, "by copying the drawings of good masters, you may afterwards copy from figures in relief."† Drawings, indeed, or prints, or even photographs, do not offer effects of perspective so deceptive or so enigmatical as those given by reliefs, or round figures; the lights and shadows in them have not the same magic, and allow of being more easily understood. And in fine, the very labour by which the author of the drawing or print has imitated the relief, or round, is, for him who seeks to imitate it in his turn, a necessary imitation in the different works of Art. Figures in relief (in the round) should not then be drawn until the student is in a condition to re-produce drawings and prints with sufficient accuracy.

Those drawings or prints, whether they represent the parts of the human figure or entire figures, ought to be the faithful reproduction of types borrowed from the best masters of all times. Photography, too, may come to the assistance of the pencil or the graver, not only in the multiplication of drawings of good authors, or of rare prints, but also even in affording direct reproductions of masterpieces of painting or of sculpture, or representations of nature.

As to models in relief, (figures in the round,) it is among the *chefs d'œuvre* of ancient sculpture that they should almost all be chosen.

Under the influence of systems in error both as to the object and the aim of Art, a custom has become established of selecting, almost exclusively, as models for instruction in drawing, among the specimens which remain to us of the ancient statuary, figures of the class called ideal figures, in which it is believed may be found the representation of human nature in its most abstract generality, figures possessing the least individuality possible; without perceiving that of these figures, those which are more remarkable for the regularity of their forms than for their truth are, for the most part, copies or imitations in which the particular character presented by the originals has more or less disappeared, and their general proportions only remain,—it is to such second-hand works that the preference is often given. And from this it arises that in learning to draw, one learns to regard only a conventional type of forms and movements, and one becomes incapable of comprehending the infinitely varied beauties of nature.

In consequence of the discovery made at the beginning of this century of a great number of original works of the finest period of Greek statuary, a discovery which vividly affected the imagination of men: in consequence also of the reaction in an opposite direction which was naturally produced by the insipidity of so many works inspired by the worship of a false ideal: the opinions which used to govern the domain of art, and that of criticism, have become modified. Individuality, Truth, Life, are restored to their rights; and it may even be doubted whether, after having so long inclined towards one of the two poles between which modern art has almost always oscillated, we have not now thrown ourselves too far in the direction of the other.

However this may be, elementary instruction has continued almost everywhere to follow the same errors as before. To cut this short it has been proposed in the commission, to allow no models in future to be taken, among so many works of ancient sculpture which remain to us, but those which carry to the highest pitch the character of individuality and truth: that is, the Portraits.

* *Della Pittura*, p. 128.

† *Della Pittura*, p. 57.

The Commission has come to the conclusion, that if this proposition should not be admitted because it is exclusive in its turn, that if, on the contrary, we cannot too soon place before the eyes of youth the *chefs d'œuvre* in which the human form, the most perfect of all forms in nature, has been represented in its highest perfection, and thus penetrate their still young imaginations with the principles and essence of the most excellent beauty, nevertheless, in order to teach them to understand and to love nature in her inexhaustible variety, it is well to give them also a certain number of masterpieces of another kind to study, so as to reproduce, from the very first, those masterpieces in which Art has expressed with the greatest *naineté* the beauties proper to individual types the most special and peculiar, without seeking to reduce them to a higher Beauty.

Moreover, those very figures should be selected which can, in a certain sense, be properly called ideal: the figures of gods, of goddesses, of heroes, of heroines, among the works of the best ages, in which the masters, penetrated with Nature and full of her spirit, have always known how to unite individuality and truth with beauty in their works. Such are the works which remain to us of Phidias or his cotemporaries, and of the great sculptors who followed immediately after him.

"The painter," says LEONARDO DA VINCI, and the same may be said of the draughtsman, "should study by rule, and should let nothing escape being treasured in his memory."* And it is therefore that he recommends the student, after having made a copy of a model as exact as he is capable of making one, to practise himself in reproducing it from memory. By this exercise, in truth, not only is the memory strengthened, without which there is neither art nor science, but also the attention, which is nothing else than the intellect itself strained and applied by the will; and in fine, those types which the student has learned to comprehend by attentive comparison of their proportions, preserved and constantly present in the imagination, become permanent subjects of new reflections, comparisons, and instruction.

To drawing after models should then be united as much as possible this practice of drawing from memory, which, long neglected, has been introduced successfully, as we have already had occasion to say, several years ago in the teaching of the special school of drawing, (*école spéciale de dessin*). But, as we have also remarked, in order that this practice should not have those inconveniences which attend on the habit of working without a model (*travailler de tête*), and that it may not keep one away from the observation and simple (*naïve*) imitation of nature, it is important, according to the express recommendation of Leonardo da Vinci, that a faithful tracing should constantly serve to verify and correct the inaccuracies of the drawing from memory; it is upon this condition that such a practice may be used, without danger, to fix in the mind the results of the imitation of models.

In making the student study and reproduce the different models, the professor should teach him to attend to the expression, above all, of their essential character, that character which is from the very first visible in the whole at one view, and which is found to be the same in the smallest details; he should teach him therefore from the first to express the general character in the whole, he should teach him in the next place never to lose this point of view, but to pursue his researches even to the details of the very smallest parts. He should apply himself thus to make his pupils understand how in the *chefs d'œuvre* of art, just as in the works of nature, the different parts are among themselves analogous in their movements, their proportions, and their forms; how, accordingly, while they have each their own peculiar nature and spirit, they nevertheless express by their correspondence and mutual agreement, the indivisible spirit which is the soul and principle of the whole; how, in them, in short, variety is thus made subject to the law of unity, which forms out of it an order and harmony.

He will apply himself to make clear how it is that in those masterpieces in which especially reign those proportions to which, with Leonardo da Vinci, we may give the name of Divine, with still greater variety is united a more perfect unity: how these two opposite elements of harmony rising at once, so to speak, to a higher power, and the unity of the idea becoming more vivid still by the very contrast of

* *Della Pittura*, p. 59.

the diversity which it subdues under its law, there results that superior harmony which constitutes Beauty; how, in short, in all true beauty, even when the character of the movements and forms is rather grace than strength, or elegance rather than majesty, nevertheless, by the predominance of the whole over the parts, of the unity over the variety of the subject, order partakes of grandeur, and with the beautiful, properly so called, is mingled more or less of what is called the sublime.

By these means he will teach his pupils by little and little to recognize in true beauty the image of that Spirit which is its divine and mysterious principle, and he will render them capable by degrees of comprehending that thought of a great master, painter, and philosopher, that the Beautiful, for all that it manifests itself in bodies, is by nature Incorporeal.*

But to teach men to judge accurately of the spirit of forms, and of beauty, which is the highest object of instruction in Drawing, the study which can be made of models copied and reproduced from memory is not enough. Their number is necessarily too much restricted. "It is not enough to draw" says LEONARDO DA VINCI, "we must still see and compare the works of different masters.†

The pupils in our schools (*lycées*) not being able to go to seek here and there the various works of art dispersed in so many places, nor even to visit, except very rarely, the Galleries where they are collected in great numbers, shall they then be deprived of this necessary complement of education? This advantage would be secured to them to a certain extent if each school were made, as far as possible, a Gallery; and this might be accomplished without much expense, by placing not only in the hall of instruction, but also in the parlour, in the refectory, on the staircases, beneath the vestibules, in the several schoolrooms, everywhere in which the arrangement of the place would allow of it, and in such a manner as to harmonize with that arrangement, reproductions, by casts, engravings, or photography, of the *chefs d'œuvre*, of every species, of ancient and modern Art. Their powerful and favorable influence would thus be everywhere and always exerted over the minds of youth; fed by the poetry of Homer and Virgil, of Corneille and Racine, it would also feed itself, every moment of the day, and almost unconsciously, upon that of Philias and Raffaele, of Jean Gonjon and Poussin.

To this programme of studies the Commission thinks it right to propose to the Minister to add one branch of instruction which hitherto has not found a place in the teaching of Drawing as it has been conducted in our schools (*lycées*), and which has nowhere perhaps been regularly organized: it is that of drawing specially applied to those forms which are altogether the creation of Art, and which, in opposition to those of natural objects, we may call *artificial forms*.‡ These forms are those of the different objects which Art invents for the various wants of life, or for the satisfaction of that which Michelangelo called the insatiable fancy of man: buildings, furniture, vessels, utensils, ornaments of all sorts.

The beings which Nature creates are in their substance and their forms that which is required for the end which they have to fulfil; and at the same time they compose harmonies, either by their figures or by their colours, which satisfy one superior and universal end, which is Beauty. The objects which Man creates for his use are also determined, both in their substance and their forms, by the very nature of the wants they have to serve. But, like nature, man also pursues at the same time a higher end. Among all substances, among all forms, he chooses as much as possible for his creations those which best satisfy the conditions of Beauty. This is not all: to these forms he adds others which may serve, either better to express the idea from which the first proceed, or else to raise their beauty; these accessories, by means of which objects tell what they mean, in some sort, with more clearness, force, and grace, and in a more elevated style—these accessories which form the poetic character of the principal forms, and

* Poussin, *Osservazioni*, p. 462: Equi si conclude che la pittura altro non è che una idea delle cose incorporate quantunque dimostri il corpi, &c.—Carducho *Dialogo*, &c. fa. 38, attributes the same thought to Albrecht Dürer.

† *Della Pittura*, p. 50.—Poussin, *Osservazioni*, p. 460.

‡ This denomination has been already employed in this sense, especially by Scamozzi.

which accompany while adorning them, as a musical harmony accompanies and emphasises the theme of the melody—these are the *ornaments* of the creations of Man. In the first place, the *forms* which Art creates for the objects necessary to the different uses of life: in the second place, the *ornaments* of which they are susceptible; such should be the double object of this new branch of instruction, which the Commission think it right to propose for institution.

Since the time which can be devoted in the schools (*lycées*) to the study of Art would not by any means suffice to complete it in all its parts, nor even in any one of them, it is evident that, instead of running over them all, so as to learn nothing, or very little, the best thing is, generally speaking, to apply ourselves to push as far as possible the study of that which is the most difficult as well as the most important, and which one cannot know without being capable of learning all the rest in a little time, that is to say, the study of the human figure. For whoever is able to represent the human figure well in its proportions, its character, and its beauty, will learn without difficulty, and in but a little time, to represent as well the proportions, character, and beauty of animals, landscape, and flowers, &c.; while the converse of the proposition is by no means true. From hence it would seem that neither can there be found a place in the schools (*lycées*) for teaching the drawing of those forms which we have just called Artificial forms. These forms, in truth, composed of the same elements as those of natural objects, do not surpass—for the most part do not even equal them in complications and difficulties. So a man may form a good judgment of the proportions of a candelabrum or vase, who could not judge as well of those of a great part of the beings which Nature has created. A man, on the other hand, who knows how to see animals and plants accurately, and therefore to draw them well, will be able to appreciate, and therefore to draw as it ought to be drawn, a vase, a candelabrum, or a volute. How much better still he who is able to understand and to trace out the cunning lines of the human figure!

But, although in the drawing of the human figure the universal principles of the drawing of other kinds of forms is included, nevertheless, each of these kinds has again its peculiar principles. Hence it follows, that in order to draw well the forms they include, and consequently to form a good judgment of their proportions, of their character, and of the particular beauty of which they are susceptible, we must unite with the study of the drawing of the human figure certain other special studies. If this is true of the forms of natural objects, perhaps it is still more true of those of which the imagination of man is the source. The forms of nature, in truth, being more or less analogous to our own, answer, by a secret harmony, to the intimate constitution of our souls, and hence it comes that even those who possess not the slightest trace of art, judge tolerably well of the beauty of such forms, whether in nature itself, or in the works of art which represent it. As to those, on the other hand, which are the creations of art, the cultivation of taste alone, by seeing and studying masterpieces, makes us capable of judging of them.

Again, for the very reason that these forms are those of objects which serve the ordinary purposes of life, and which our wants, or the variations of fancy, invite us perpetually to alter and renew, we have to exercise our judgment upon them continually; and this is another reason why it is desirable that studies of a special nature should put us in a condition to bring an enlightened judgment to the task.

To this consideration is to be added another, drawn from the interest of these arts themselves, with which, in our country of France above all, so many other interests are connected. If the destiny of Art, in general, depends in great part on the opinion, more or less enlightened, of the public, this is especially true of those arts which are closely connected with Industry, and which cannot dispense with the connection. Separated from the public by intervening circumstances, more or less numerous, scarcely known to it, even the artist who, in these arts which are reputed as secondary, displays the rarest ability, produces no impression by the authority of his name, and exercises but a weak influence on the judgment of the majority of men. If, besides, in order to judge of pictures and statues, we are well content to defer to a certain extent to those skilled in the knowledge and practice of painting and sculpture, and who, in consequence, are necessarily the

best judges of such works, still the same thing is not true in the case of those familiar articles by which we are surrounded, and of which we are making some use every moment, and every one willingly thinks himself capable of forming a judgment as well as any body else.

Lastly, let us add that if of all the branches of Art the Drawing of such objects as industry appropriates to the various uses of life is not the most elevated, nor that, consequently, which can most contribute to the education of the soul and the mind, it is that which, on the other hand, in addition to the advantage of enabling us to exercise a judgment upon those things of which we have the most frequent need, unites this advantage, too, (which is a necessary consequence of the former,) —that of finding immediate employment in the greater number of industrial professions and trades.

In giving, then, the first and highest place in the study of the elements of art to the Drawing of the Human Figure, which is its highest branch, it seems that there are sufficient reasons to make room also for that branch of art which in some sort occupies the other extremity of the scale, and whose direct applications are by much the most numerous as well as, materially at least, the most useful.

Since those forms which are the creations of the imagination divide themselves naturally, as we have said, into two great classes: namely, the figures themselves of buildings, furniture, utensils, &c., and the ornaments with which these different objects may be clothed, the teaching of the Drawing of artificial forms should also be divided into two portions, corresponding with these two classes of objects.

During the first portion of this teaching, the student should be made to study at first select profiles of some of the principal features of which Architectural Buildings are composed, then Vases, Brackets, Vasques, Balustrades, Candelabra, &c., adding sometimes the study of the ground plans of architectural works to that of their profiles. In directing the study of these objects, as in that of Man, the master should apply himself to make it clear how the proportions of the different parts depend on one another, and vary one with another; how in this agreement and connection, which give to every work of art its special beauty, as well as its definite character and expression, the thought shines out, the spirit which produced such forms; how from the harmonious concert of those proportions which LEONARDO DA VINCI called "divine," results at last the perfection of Beauty.

To this teaching should be joined the exhibition, by a sufficient number of examples, of the several modifications which the various forms must undergo, and the particular characters or expressions which they must assume, according to the difference of substances, following the different nature of marble, of stone, of granite, of wood, of ivory, of iron, of bronze, of the precious metals, &c.

In directing the special study of ornamentation, the professor should make known both the principal types which art has created, and those which it most commonly borrows, whether from the animal or vegetable kingdom; he should, above all, explain how it modifies the elements supplied by nature, and transforms them so as to please the fancy of men.

For every branch of this course of study, the models should in general be borrowed from Greek Art, which, in this department as in all the others, knew how to unite with the most perfect agreement of the forms, with the destination of the objects and their material, the greatest originality of character, the highest style, and the most surpassing beauty. Other models may, however, be added, borrowed from Roman and Oriental art, as well as from that of the Middle Ages, and of the *Renaissance*, which, though they do not reach the same degree of supreme perfection, have, nevertheless, produced a crowd of masterpieces in this department.

The exercise of reproduction from memory, which would fasten in the imagination the most finished types, should be applied to the drawing of artificial forms and their ornaments, as well as to that of the human figure, and will produce the same result.

Perhaps to these studies, should be added some practical lessons on the employment of colour in ornamentation, lessons which would initiate the student to a certain extent in the knowledge of the relations and harmonies of tones in colour.

To conclude, as in the case of figure drawing, besides the models of artificial forms, which may be made during the progress of the course, other *chefs-d'œuvre* of art, placed in every direction throughout the schools (*lycées*) under the eyes of youth, would succeed in penetrating them with the spirit which produced them, with that universal spirit from which equally proceed the heroic *contours* of the marbles of the Parthenon, and the profile of the least of the earthen vases hidden in the sepulchres of Athens or of Vulci.

[The Commission proceeds to point out the proper distribution of all these studies among the classes in the *lycées*, the schools of general education in France, (the details of which we may omit for the present,) and concludes thus :—]

In order that the teaching of Drawing, thus regulated, may bear the fruit which the Commission believes may be borrowed from it, there is still one important condition to be fulfilled, and that is, that the masters charged to conduct it, be at all points equal to their duties.

Up to the present time these masters have been chosen by the Masters of the *Lycées*, without any sort of legal guarantee, and, although there may always be found among them, and there still are, men of much knowledge and ability, it must be confessed that the situation prepared for them has not been in every point of view of a kind to attract merit.

The Commission feel it to be their duty to propose to the Minister, to establish it as a principle, that there shall in future be a special examination of the capacity of candidates for employment as Masters of Drawing, the subjects of which shall be determined by a special ordinance; that those alone who shall have successfully undergone this examination, shall in future be intrusted with the teaching of Drawing in the *Lycées*, with the title of Professors; and that to this title shall be attached sufficient emoluments. The same title of professor, together with the advantages belonging to it, might, however, be immediately conferred without any examination, on those masters who have rendered long and efficient service in the various establishments of public instruction.

No establishment can preserve its existence, unless constant vigilance be employed, to remove everything which tends necessarily to destroy it. In the teaching of Drawing, as in all branches of education, frequent inspections are then, in the opinion of the Commission, absolutely necessary. These inspections should naturally be confided to men possessed of the special knowledge which they require.

Lastly, it would be useful, if not even absolutely necessary, that a special committee should be charged to examine the observations sent in by the inspectors, to discuss the propositions which may be appended to them, and to submit to the Minister such of them as may appear suited, whether for the preservation of instruction in Drawing from every cause of degeneration, as the system is at present settled, or for making it more and more perfect as it continues to work.

Such is the plan of the studies which we are of opinion would be most suitable for the teaching of Drawing in the schools (*lycées*) of the French Empire, and such the measures of administration which appear to us the most proper to secure its success.

[Upon this admirable report, the Minister of Public Instruction has promulgated a Decree, by which, adopting every suggestion contained in it, he has fixed the course and manner of instruction in Drawing as a branch of the excellent system of National Education in France. Upon that system we may have on another occasion to speak at some length, and so far as this branch of it is concerned, we shall very shortly take an opportunity of comparing the plan so powerfully enunciated by M. RAVASSON and his colleagues, with that which has been set up under the auspices of the English government. In the mean time, the local committees and masters of our drawing schools in Ireland, may find means to put in practice much of what they will find so clearly and ably laid down in the above document.]

ART. II.—NOTICES OF BOOKS, &c. *The Natural History Review*, April, 1854. Dublin, Hodges & Smith, Grafton-street. London, Simpkin, Marshall, & Co., and Samuel Highley. (Published quarterly, single number, 2s., annual subscription, 6s., payable in advance.)

A country with a population of from six to seven millions of inhabitants, speaking a language in common with some sixty millions of others distributed over the five Continents of the earth, ought certainly offer an excellent field for the development of a periodical literature. Yet Ireland has not one, and notwithstanding the very many attempts which year after year have been made to supply some special part of the deficiency, we are but little further advanced than we were many years ago. Until very recently the two or three periodicals published in the country too were of a purely literary character. We had no representative of Art, nor have we yet—no representative of industry until the journal for which we write made its appearance, and no representative of abstract science. The only cause which strikes us as capable in any degree of accounting for the actual state of things, is perhaps a species of indifference to any progress which might be effected in the country not conducive to the special ends of some party. And that very indifference extends, not merely to the public who should support a literature, but even to the writers, literary, scientific, and artistic, who should create it. There has also perhaps been a deficiency of speculative energy among Irish publishers, who might have learned an excellent lesson from our Scotch neighbours, who have established a most respectable, indeed we might almost say the most respectable periodical literature in these countries, the chief market for which is not in Scotland, but out of it.

It may be, that we are now about to raise ourselves from the slough in which we have so long lain, and having learned some self-respect, and thereby acquired the virtue of self-reliance, earnestly begin to remedy our short-comings. There are certainly many symptoms of a healthier public opinion, than has heretofore prevailed; may it grow stronger and stronger every day, and finally learn to discard altogether the quack remedies which have been prescribed for it so long; party hatred, flunkeyism, and the servile imitation of every thing, without discrimination, which emanated from the opposite side of the channel.

As indicative of this growing change, we welcome with sincere pleasure the appearance of a new Irish periodical (it has just the same age as our own) devoted to Natural History, and which although apparently foreign to our objects, we cannot resist drawing the attention of all our Irish readers to. We say apparently foreign, for in reality the progress of no science can be foreign to industry, for does not every day show us how the most abstract, and in a practical point of view, apparently the most useless fact, becomes the germ of new branches of the industrial arts, and the basis of great manufactures! We may even point to the pages of our own journal, which is purely industrial, as a proof of the benefits conferred upon industry by Natural History, in the case of the artificial production of the

oyster and of fish. And here we may remark, that it is not merely to the higher and more important studies of the great naturalist, that we are indebted for practical results, but also to the humble collector, and to those who are content to confine their exertions in some limited local field, and whose labours will be chronicled in this new periodical.

The Natural History Review consists essentially of three parts: 1, Reviews of books connected with the natural sciences, including under this head, Geology, Physical Geography, and scientific books of travels. 2, Proceedings of various Irish local and metropolitan societies which occupy themselves wholly or in part with the study of the natural sciences. And 3, Notices of several serial publications connected with Botany, Zoology, &c. It is thus an unpretending, but not the less highly useful journal.

All books devoted to special subjects must necessarily attract less attention than works on general literature; hence men removed away from the centres of science which are constituted by large cities or universities, have no means of becoming acquainted with this special literature; to such then as have an interest in the Natural Sciences, the first department of the Natural History Review will be of eminent service.

We cannot speak too highly of the second department, namely, that devoted to the labours of isolated local societies. To these bodies it indeed will give a real living existence; for hitherto they have been dead so far as their labours in science were concerned. There are no sciences which could derive so much benefit from the labours of local societies as the very ones to which this review is devoted, and none for which all may so easily assist in collecting materials. We hope, therefore, that every exertion will be made to chronicle the labours of every one which exists in the country.

With regard to the third department we would respectfully suggest some improvements. In the first place, we consider it more important than the reviews of books, and we would like, therefore, to see it receive the largest amount of space. Few persons, even those professionally occupied with science, are able to purchase all the journals connected with any particular science, and least of all those upon natural history, which are so numerous; and even if they could, the labour of reading them, and the knowledge of languages which should be possessed, would be a great barrier. No greater service, therefore, could be rendered to science, than to give a real catalogue *raisonné* of the contents of the chief journals of Botany, Zoology, Comparative Anatomy, History, and other branches of Natural Science published in Europe. This could be done, as at present, by taking each journal respectively, or what would be better, but we must also admit more laborious, by a series of quarterly reports upon the progress of each of the different branches of science. If this could be effectually carried out it would supply a great want, not alone in Ireland, but in great Britain also.

In conclusion, we would recommend every body who can afford it, and who takes an interest in the real welfare of the country, to subscribe to it, not merely for its own merits, but also for the good which may be produced by the development of a scientific literature in Ireland.

JOURNAL OF SOCIAL PROGRESS.

ART. I.—BANKING. *Banking in Ireland, No. II.*

STATE OF THE LAW.

IN our first section under this heading, published in the April number of this Journal, we explained to the reader some general principles in relation to which we viewed banks and banking operations in Ireland and elsewhere. We concluded that article, by a reference to the state of the law as affecting the circulation of bank notes in Ireland, in the following words:—“Particularly at a political juncture such as the present, with war impending, it is vastly for the interest of the State that its surplus capital should be retained, and wrought into the internal industry of the country; but we could easily prove that maintaining a composition duty or tax upon notes which a banker circulates on the metallic basis, and the rendering it compulsory on him to make his notes payable where issued, whilst he has to keep pound for pound in specie against these notes at another place, is to afford capital a direct premium in favour of its exportation.” We now proceed to prove and exemplify this position by a reference to the state of the law.

The 9th Geo. IV., cap. 80, gave the registered bankers of Ireland permission to issue promissory notes payable to bearer on demand.

The 9th Geo. IV., cap. 81, prohibited bankers in Ireland from issuing or re-issuing notes or post bills of any denomination, which should not be payable *at place where issued, and so expressed therein*.

The 5th & 6th Vict., cap. 82, enacted that the same duty shall be payable by bankers in Ireland as was then payable by bankers in England on the average amount of notes in circulation; viz., 3s. 6d. per cent. per half year—say 7s. per cent. per annum.

We have, for sake of conciseness, stated the substance of these enactments, instead of reciting the precise words of each Act; and we have to request the reader to bear in mind that the three statutes referred to constituted the law on the subject to which our attention is now directed, at the period of introducing Sir Robert Peel's Act, the 8th & 9th Vict., cap. 37.

And here we shall offer a few observations as to the spirit and policy of Sir Robert Peel in his English and Irish Banking Acts. They were simply these:—Sir Robert Peel assumed, on grounds which we certainly shall not call in question, that a pound sterling should represent a certain intrinsic value, and not an arbitrary credit; that, in fact, a pound sterling

should be itself an exchangeable item of commerce, wherewith one could easily pay for wheat in Odessa, for cotton in America, or for sugar in Brazil.

Sir Robert Peel did not question the propriety of having this pound sterling in circulation in the guise of a bank note, but he assumed that such note should, at the will of the holder, be convertible into the precious metals, which constitute the real pound sterling; and the main object of his bill was to provide, not only that the holder should have this *right*, but that a system should be devised whereby the banker in future (except in respect to a limited amount of notes) should *in fact* have an equal amount of gold at a certain depot or at certain depots to represent his notes in circulation.

Sir Robert Peel proposed to deal with the vested interests of circulating bankers in the manner hereinafter explained, and carried his propositions into practice.

The amount of the average circulation of the joint-stock banks in Ireland, issuing notes, during one year preceding the first day of May, 1845, was found to be £6,354,494; up to which date there was no actual statutory obligation on the banker to hold any particular proportion of specie. Of course, he should hold specie to meet any demand made on him for payment of his notes, but it was a matter of discretion how much he held, or where.

The circulation of £6,354,494 was maintained by eight companies in the following proportions:—

The Bank of Ireland maintained a circulation of	...	£3,738,428
Provincial Bank of Ireland	... ..	927,667
Northern Banking Company, Belfast	... ..	243,440
Belfast Banking Company	... ..	281,611
National Bank of Ireland	... ..	761,757
Ulster Banking Company, Belfast	... ..	311,079
Clonmel National Bank of Ireland	... ..	66,428
Carrick-on-Suir National Bank of Ireland	... ..	24,084

When the reader has comprehended the provisions of the three Acts of Parliament, the 9 Geo. IV., cap. 80, the 9 Geo. IV., cap. 81, and the 5 & 6 Vict., cap. 82, already referred to, and when he has acquainted himself with the facts just stated as to the circulation of the country up to the 1st of May, 1845, he will be, for all the purposes of this paper, in possession of the state of the law and the state of the case when Sir Robert Peel introduced his Irish Banking Act, the 8 & 9 Vict., cap. 37, dated the 21st July, 1845. The eighth section of that Act is as follows:—

“VIII. And be it enacted, that every banker claiming to be entitled to issue bank notes in Ireland shall, within one month next after the passing of this Act, give notice in writing to the Commissioners of Stamps and Taxes, at their head office in London, of such claim, and of the place and name and firm at and under which such banker has issued such notes in Ireland during the year next preceding the 1st day of May, 1845, and thereupon the said Commissioners shall ascertain if such banker was on the 6th day of May, 1844, and from thence up to the 1st day of May, 1845, carrying on the business of a banker, and lawfully issuing his own bank notes in Ireland, and if it shall so appear, then the said Commissioners shall proceed to ascertain the average amount of the bank notes of such banker which

were in circulation during the said period of one year preceding the 1st day of May, 1845, according to the returns made by such banker in pursuance of the Act passed in the fourth and fifth years of the reign of her present Majesty, intituled 'An Act to make further Provisions relative to the Returns to be made by Banks of the Amount of their Notes in Circulation,' and the said Commissioners, or any two of them, shall certify under their hands to such banker the average amount, when so ascertained as aforesaid, omitting the fractions of a pound, if any; and it shall be lawful for every such banker to continue to issue his own bank notes after the 6th day of December, 1845, to the extent of the amount so certified, and of the amount of the gold and silver coin held by such banker, in the proportion and manner hereinafter mentioned, but not to any further extent; and from and after the 6th day of December, 1845, it shall not be lawful for any banker to make or issue bank notes in Ireland, save and except only such bankers as shall have obtained such certificate from the Commissioners of Stamps and Taxes."

The 14th section next interests us. It thus carries out the previously quoted section:—

"XIV. And be it enacted, that from and after the 6th day of December, 1845, it shall not be lawful for any banker in Ireland to have in circulation, upon the average of a period of four weeks, to be ascertained as hereinafter mentioned, a greater amount of notes than an amount composed of the sums certified by the Commissioners of Stamps and Taxes as aforesaid, and the monthly average amount of gold and silver coin held by such banker during the same period of four weeks, to be ascertained in manner hereinafter mentioned."

The 16th, 19th, and 20th sections next deserve attention, and are as follow:—

"XVI. And be it enacted, that every banker who after the 6th day of December, 1845, shall issue bank notes in Ireland shall, on some one day in every week after the 13th day of December, 1845 (such day to be fixed by the Commissioners of Stamps and Taxes), transmit to the said Commissioners a just and true account of the amount of bank notes of such banker in circulation at the close of the business on the next preceding Saturday, distinguishing the notes of five pounds and upwards, and the notes below five pounds, and also an account of the total amount of gold and silver coin held by such banker at each of the head offices or principal places of issue in Ireland of such banker at the close of business on each day of the week ending on that Saturday, and also an account of the total amount of gold and silver coin in Ireland held by such banker at the close of business on that day; and on completing the first period of four weeks, and so on completing each successive period of four weeks, every such banker shall annex to such account the average amount of bank notes of such banker in circulation during the said four weeks, distinguishing the bank notes of five pounds and upwards, and the notes below five pounds, and the average amount of gold and silver coin respectively held by such banker at each of the head offices or principal places of issue in Ireland of such banker during the said four weeks, and also the amount of bank notes which such banker is, by the certificate published as aforesaid, authorized to issue under the provisions of this Act; and every such account shall be verified by the signature of such banker or his chief cashier, or in the case of a company or partnership, by the signature of the chief cashier or other officer duly authorized by the directors of such company or partnership, and shall be made in the form to this Act annexed marked (A.); and if any such banker shall neglect or refuse to render any such account in the form and at the time required by this Act, or shall at any time render a false account, such banker shall forfeit the sum of £100 for every such offence.

"XIX. And be it enacted, that for the purpose of ascertaining the monthly average amount of bank notes of each banker in circulation, the aggregate of the amount of bank notes of each such banker in circulation at the close of the business on the Saturday in each week during the first complete period of four weeks next after the 6th day of December, 1845, shall be divided by the number of weeks, and the average so ascertained shall be deemed to be the average of bank notes of each

such banker in circulation during such period of four weeks, and so in each successive period of four weeks; and the monthly average amount of gold and silver coin respectively held as aforesaid by such banker shall be ascertained in like manner from the amount of gold and silver coin held by such banker at the head offices or principal places of issue of such banker in Ireland, as after mentioned, at the close of business on such day in each week; and the monthly average amount of bank notes of each such banker in circulation during any such period of four weeks is not to exceed a sum made up by adding the amount certified by the Commissioners of Stamps and Taxes as aforesaid and the monthly average amount of gold and silver coin held by such banker as aforesaid during the same period.

"XX. And be it enacted, that in taking account of the coin held by any banker in Ireland with respect to which bank notes to a further extent than the sum certified as aforesaid by the Commissioners of Stamps and Taxes may, under the provisions of this Act, be made and issued, there shall be included only the gold and silver coin held by such banker at the several head offices or principal places of issue in Ireland of such banker, such head offices or principal places of issue not exceeding four in number, of which not more than two shall be situated in the same province; and every banker shall give notice in writing to the said Commissioners, on or before the 6th day of December next, of such head offices or principal places of issue at which the account of gold and silver coin held by him is to be taken as aforesaid; and no amount of silver coin exceeding one-fourth part of the gold coin held by such banker as aforesaid shall be taken into account, nor shall any banker be authorized to make and issue bank notes in Ireland on any amount of silver coin held by such banker exceeding the proportion of one-fourth part of the gold coin held by such banker as aforesaid."

The reader is now in possession of the state of the law as at present affecting the circulation of bank notes in Ireland, in every point material to the question under discussion. We may add, as an item of information, that every bank in Ireland, except the Bank of Ireland, is now in excess of its fixed issue, and therefore at present circulating notes against gold held at depots.

In this state of facts and state of the law we beg, for the interests of the public, to urge the following reforms upon the Chancellor of the Exchequer, which will not be found to operate in the least in violation of the policy of Sir Robert Peel's Act, nor indeed in opposition to the letter of the Act.

1st, The repeal of so much of the 5th & 6th Vict., cap. 82, and so much of any other Act of Parliament as enables an amount of composition duty on circulation to be charged greater than that which would be payable on the amount of the circulation certified agreeably with 8th section of the 8th & 9th Vict., cap. 37; that is a limitation of the maximum composition duty payable by any banker to an amount equal to 3s. 6d. per cent. per half year on the amount of his *certified* circulation for the year ending 1st May, 1845.

2nd, The repeal of so much of the 9 Geo. IV., cap. 81, and so much of any other Act of Parliament as restricts a banker in Ireland from issuing any notes not payable at the place where issued; and a provision that a banker may be at liberty to issue in any part of Ireland notes *made payable at one or more of his chief places of issue only*, whenever such notes are issued against an equivalent amount of gold held at such chief place or places of issue, as prescribed under the 7 & 8 Vict., cap. 37, sec. 20.

To illustrate a case often saves a tedious demonstration. We will take an example of how the present law may be brought to bear, and shew how it certainly presses against the interests of the public.

All the banks of Ireland, except the Bank of Ireland, being in excess of their certified circulation, are at present issuing against specie. They are, nevertheless, large holders of capital, and have a considerable sum at present awaiting safe and profitable employment.

Let us suppose two rival candidates for an advance of £100,000, applying to one of the eight companies named.

A harbour is to be constructed, say at Galway; there is a company, we shall suppose, formed to carry out the works; the outlay will be altogether made in Ireland; the security is unquestionable; 6 per cent. per annum is offered for the advance.

Our second candidate for the advance we shall suppose to be some foreign banker, who has contracted a French, a Prussian, or a Russian loan; his security we assume to be equally good; but he wants the money to ship it abroad, and he will only pay 5 per cent. per annum for the use of the money.

Unhesitatingly the reader says, the security being equally good, and the rate of interest higher, lend the money *of course* to the Galway contractors, who will employ it at home. We, however, undertake to show that the bank so acting may act very patriotically, but will do so at the direct sacrifice of profit.

In the case of the advance to the foreign banker, a check on the Bank of England for the £100,000 completes the advance.

In the case of the Galway company, they will circulate the company's notes at or near Galway to the extent of £100,000, or thereabout; in fact, money will not largely circulate in Ireland except in notes, and is difficult of disbursement in any other shape.

The banker, being already in excess of his fixed issue, has to deposit £100,000 in gold at one of his depots, under the 7 & 8 Vict. cap. 37, sec. 20; and as this is a costly process, we shall set down for this a quarter per cent. if you please, and a quarter per cent. for removal back from the depot when no longer required. But further, under the 9 Geo. IV., cap. 81, the banker must make his notes payable at Galway, the place where issued; and this not being one of his four depots, he is obliged to lodge more gold at Galway—say £10,000—to meet the chance of demands for payment there: this causes an amount of £110,000 gold to be actually necessary to the banker, who requires to issue £100,000 only in notes; and this, as the reader will perceive, is equivalent to the reduction of a half per cent. on the interest receivable for the advance of £100,000. We have therefore (not to speak of the cost of making notes, which has also to be borne by the banker) reduced the charge of 6 per cent. for an advance in Ireland to be only equivalent in point of remuneration to a charge of 5 per cent. on a foreign loan. But we are not yet done with the recital of the drawbacks and disadvantages attending the domestic employment of the money; for under the 5 & 6 Vict., cap. 82, the banker has to pay 7*s.* per cent. per annum as a composition duty on the circulation of £100,000 notes, which not only are *not in the nature of a credit* to him, but are a source of cost, and represented by £110,000 specie; and it thus comes to pass that at the present moment it is at least equally profitable for an Irish

banker to receive £4 13s. per cent. for an advance on French *Rentes* as to receive 6 per cent. for an advance which has to be disbursed by the circulation of his notes within the realm.

The party chiefly interested in all this is the public; the extent to which the banker's interests are damaged is very small in comparison to the injury to commerce and industry; and with this view we most heartily commend the subject to Mr. Gladstone's consideration.

We have cautiously abstained from overstating any feature of the case; we have avoided any declamation on the subject as a national injustice, for we feel satisfied the error does not lie with the framers of the last Bankers' Act, 8 & 9 Vict., cap. 37; except that they did not sufficiently understand all the working of the pre-existing law; and that they did not repeal sufficiently the old law to insure the measure of Sir Robert Peel a wholesome operation.

ART. II.—*An Irish National Gallery.*

WE have taken occasion more than once to urge the weighty importance of cultivating the general taste of the people by every means by which their spiritual instincts and power may be evoked and encouraged; because such cultivation is precisely that which alone leads to true civilization, that civilization which mere material prosperity does not secure, and towards which the most extensive system of "primary education" only supplies the first necessary appliances whereby men can educate themselves indeed, —but in a wrong and useless as easily as in a right and beneficial direction. And to cultivate a more refined taste, and suggest in the mind of the hard-working man ideas of abstract instead of practical, or of spiritual instead of material value, after the influence of Religion itself, there does not seem to be any agent in existence so powerful as pure Art. This is doubtless the noblest power of Art, and it is the recognition of this power which has ever raised the cultivation of the Fine Arts, among the noblest nations of ancient and modern times, to so high a place of honour among intellectual occupations, and has oftentimes induced nations poor in material possessions to spend vast sums upon great public collections, in the study of which the whole people would find advantages not to be measured by millions of mere money. It is true that the uneducated classes (and how many unfortunately are still to be classed under that name!) do not and cannot study the contents of a Gallery of Art either practically or critically. But it is equally true that the more they become accustomed to the sight of noble imaginative works, the more of the spirit of these do they carry away unconsciously in their minds. And this is Education, and education even of very decided practical importance.

'It was with such views that in the very opening number of this *Journal* [Jan. 1854] we thought it right to introduce prominently the subject of

National and Provincial Galleries of Art, open to the public, and to direct especial attention to the undertaking commenced last winter with the object of founding a National Gallery in Dublin,—we mean the new IRISH INSTITUTION. It is true that we do not write for Dublin only,—nor even for Ireland only,—and so our observations on that occasion were directed to suggest in many other places also similar efforts, in each on a scale proportionate to its means: (and instances were quoted of successful local exertions in this direction in various parts of France,* which might readily be paralleled elsewhere, and even in many of our Irish provincial cities). But each example of such an undertaking as that of the Irish Institution is full of practical value, because it affords to any new exertions the benefit of detailed experience already bought,—and for this reason, quite as much as with a view to make known and thus to assist the action of that body, we gave a complete account of its establishment and prospects. In prosecution of the same objects, and with the same intentions exactly, we have now to note down the experience of a First Exhibition just concluded, the details of which have been very properly made public, with the utmost minuteness, by the Committee of Management. It is certainly with no little gratification that we find that experience presenting, on the whole, a satisfactory result, and that the important institution projected in November bids fair speedily to become a permanent public establishment.

In a country such as Ireland, not yet possessing any substitute whatever for the national collections of other lands (although inhabited by a population peculiarly likely to profit by, and therefore peculiarly in want of such an institution), the importance of a public gallery of Art rises almost to being a necessity. And for a population so large,—one too of which so vast a proportion is already supplied with a substantial elementary education, inevitably calculated to spur it on to greater and greater mental progress,—a National Gallery should be very extensive, and of a very superior character indeed, to be capable of supplying worthily the national wants. In every other country institutions of National importance and extent are generally founded, if not always carried on, at the expense of the whole state. In this country, unfortunately, the time is past, or else it waits us still far in the future, in which such national support is possible. For the present, therefore, it is upon private exertions alone that we are forced to depend, and even in richer lands than ours there are not always, nor easily to be found, so many men of taste and public spirit who have the means (and with them the active wish) to step forward to fill the place which a National Government ought more properly to occupy. In Ireland every such undertaking is, for many obvious reasons, peculiarly difficult: in Ireland the first attempt at such a one as that of which we are now writing must necessarily be more of an experiment than anything else. For

* In stating what has been done by the people of Havre for the establishment of a Museum of Art and Science in that city, an unfortunate misprint occurred in our paper in the first number [Jan. 1854, *Journal of Social Progress*, p. 7], which was only corrected the succeeding month. The amount subscribed by the inhabitants of Havre towards the construction of their *Musée* was in reality 400,000 francs, or £16,000 sterling.

we always feel here that no scheme, however apparently practicable, and however great its importance, can calculate on certain success. And so it was that those who engaged in the formation of the Irish Institution for the establishment of a National Gallery, engaged in it as an experiment only in the first instance. The mode in which they proposed to secure an immediate Exhibition of works of high Art has been already recorded in detail [*ante*, pp. 7—11]. We have now to make note of the results of their exertions, so far as the five months of the First Exhibition are concerned.

Our readers, as well as the Dublin public at large, are aware that the Institution was established immediately after the close of the Great Industrial Exhibition of 1853, in order to make use of the opportunity presented by the bringing together of the immense collection of Works of Art there displayed, to make the commencement of a more permanent exhibition of the same nature, and, (in the first instance at least,) in the same manner and on the same terms. The eventual development of such an Exhibition,—the formation of a true *National Gallery*, consisting of *select* works, the property of the nation, and to be constantly opened to the entire people,—was, however, from the very first, kept steadily in view; and with this object, donations of Works of Art of all kinds were solicited to form the nucleus of a public collection. Even from the first a strong disposition became manifest on the part of those possessed of such works to aid in forwarding the scheme, and the committee were obliged from the first to exercise a rigorous judgment in determining what works were worthy to be admitted into a great educational exhibition. For the great design of a National Gallery would be entirely frustrated if inferior pieces were permitted to furnish its walls, because by these the public taste would be corrupted, not improved. Notwithstanding, however, the strict criticism to which proffered donations were necessarily subjected, the committee have even already received several valuable gifts every way worthy of their acceptance,—many more have been promised,—and several donations in money have been paid into the bank, to be expended, when these sums shall have reached a sufficient magnitude, in the purchase of works of art, as occasion may offer. And the paintings already presented are precisely of the class most suitable for a public exhibition: they are chiefly gallery pictures, of a size as well as character the best calculated to embolden the efforts of the true student, while they supply fine examples for his education in general design, as well as in the technical minutiae of the art.

That these donations have not been much more numerous, and still more important in character, is known to be due not so much to any apathy towards the new institution on the part of the many possessors of valuable works among us, as to another cause which is now very likely to be speedily removed. It has been generally felt, (as indeed the promoters of the undertaking have never concealed,) that the establishment of the Institution this winter has been rather experimental in the first place than certain to be permanent. There was no time at the close of the Dublin Society's Exhibition to take decisive measures for securing a permanent home for the incipient National Gallery, and the novelty of the

plan suggested as preparatory to such an establishment, was felt to make any very energetic efforts in this direction seem rather premature. The importance, even the necessity, of securing eventually a permanent building suitable for, and exclusively devoted to a Gallery, was indeed early asserted by the Committee,* but the success of the exhibition during the first season was looked forward to as a necessary preliminary to entering upon the requisite arrangements for that purpose. And until the great desideratum of a local habitation (permanent and certain as it should of necessity be) was supplied, or rendered certain to be supplied, men hesitated to present to the young association works of art which in their private houses formed so great an ornament of daily life, and were felt to be also secure there to the country.

But some little delay in securing a special exhibition building was found to be productive of no immediate inconvenience. In the midst of the discussions upon the subject, the Royal Hibernian Academy, with proper regard to their position at the head of Art-Education in Ireland, came to the assistance of the institution, and placed their galleries at its disposal, until they should be required for their own annual Exhibition in the summer. In these galleries, then, the rare and admirably selected collection brought together by the exertions of the Committee have been exhibited since the first day of the year, with what effect we shall presently see. The summer Exhibition of the Academy is appointed to be opened next month, and that of the Institution had accordingly to be limited to the months of January, February, March, April, and May; but arrangements have already been made to re-open a new Exhibition immediately after the close of that of the Academy in autumn; and it is stated that so many valuable works are already promised by their owners for that purpose as will secure to us, during the next winter, the opportunity of becoming acquainted with a collection not inferior in interest or value to that from which we have received so much instruction and delight during the past six months.

Before recording here the already published statistics of the past Exhibition, it is proper to declare that the attendance of the general public of Dublin has certainly not been so full or so constant as might have been expected in a city of its population and intelligence. It is true that in a pecuniary point of view the labours of the Institution have been successful, at least so far as to have escaped pecuniary loss. But very much greater success ought to have crowned those labours. The comparative smallness of attendance on the part of the public may, however, be accounted for by two or three facts which appear to be peculiar to the occasion, place, and circumstances of this first Exhibition, and these,—without dwelling further on them,—may be here briefly noted. In the first place, a considerable number of the paintings included in it had already been placed before the Dublin public in the Great Exhibition, during the whole of the previous summer, and had been so carefully and constantly scanned by thousands there, that the Dublin public were pretty well accustomed to them. And

although it is true that the Exhibition of the Institution contained nearly as many paintings that had not been recently exhibited as of those transferred from Merrion-square, still it had a vague reputation of being composed almost altogether of the latter. No doubt the majority even of these may be said to have been seen for the first time in Abbey-street, (for they were very ill arranged in the Dargan building,) and no doubt also that first-class pictures ought to be seen and studied again, "many a time and oft," and ever most carefully, in order that even the most educated eye may be able to penetrate their full meaning. But the ordinary crowd (and especially that of a city hitherto unaccustomed to works of art) does not consider those things, and requires very much of habit and the education it brings before it can begin to appreciate them.

In the next place, the situation of the Academy House, in Abbey-street, was certainly unfavourable, at least during the winter months. The chief part of those most likely at first to frequent an Exhibition of so high a class live rather at the other side of Dublin; and though during the summer season (when the Academy Exhibition is open) this disadvantage can scarcely be said to exist, still in the winter time of our moist climate it certainly did produce its effect. An exhibition of this kind in Merrion-square would, in the winter season, command four times the number of daily visitors. And in addition to these causes, another, though a more trifling one, certainly affected the Exhibition of the new Institution,—to whose name, even as a distinct body, the public had yet to be accustomed; and that was, that another exhibition of pictures, which was extensively advertised, was open during the entire winter, in a more central situation, and was held in a building which had long been known by a name almost identical with that of the new association,—the name indeed of another very similar society which did many years ago exist in Dublin.

When it is considered what very trifling causes may seriously affect the success of an *exhibition* of any kind, some excuse will readily be apparent in those above mentioned, for what may appear the carelessness of the people of Dublin towards the Irish Institution. But we have (not unintentionally) marked first the shadow of our picture, for it will be seen that even in spite of these little drawbacks, the Exhibition has been successful, because so considerable a number of annual subscriptions were received as to secure a fund amply sufficient to pay all the expenses. Whether during its first years the Institution will find itself able to bear in addition the expense of a suitable building may yet be doubtful, but in the mean time the Hibernian Academy have liberally undertaken to lend their rooms, free of any charge, during the winter season, and to take charge of works of art lent to the Institution, during the interval of their own annual exhibition.

It has been observed before, that the committee of the Institution paid zealous attention to the proper selection of works admitted to the exhibition just closed, and the success of their judicial exertions was abundantly evident to every visitor. The contents of the past exhibition were, however, extremely varied,—containing specimens of almost every department of art, and of most of the great schools of Europe; many of these had never been exhibited in Ireland, and some of them were of artists,

none of whose works we believe had ever been seen here before. (Of the latter, may be particularly mentioned, the three rare and beautiful specimens contributed by MR. G. H. VERNON, M.P.—the Zurbaran, the Hans Memling, and the Franciabigi.) Of the entire exhibition, almost one-half was new to Dublin, even after the Great Exhibition of 1853. The arrangement of the collection was also calculated to instruct the eye. The general effect of the great room was strikingly harmonious, (an effect altogether produced by the most careful and laborious inter-arrangement of its contents), and while no great space was lost, every picture was hung where it might be best viewed, and the absence of that crowding which generally hurts all our exhibitions of art contributed an expression of dignity and repose to the whole. The visitors too were supplied with admirable catalogues (and at the unprecedentedly low rate of 2*d.* each), which contained a surprising quantity of valuable information. An excellent general introduction, on the schools of art and its general history, and a full and complete index of the artists represented, giving the requisite details about them, and marking their schools and styles, were drawn up by MR. G. F. MULVANY, R.H.A., the accomplished Honorary Secretary of the Institution; and the large circulation of this excellent little work among those who visited the collection, could not fail to assist materially the educational objects of the undertaking.

The committee, in the mean time, did not neglect the special wants of those who desired to make use of the exhibition for directly practical purposes, and the last two days of the week were reserved expressly for artists and students, in addition to the mornings of every other day up to 12 o'clock. No less than 49 artists and students in Dublin were found to have profited by this judicious arrangement during the five months of the Exhibition, and in the majority of instances, the copies and studies made were of the most important character. During the last two months a very much increasing interest became manifest in this department of the establishment; and we hear on all hands congratulations upon the impetus even already given to the study of Art in Dublin, by the opportunity thus afforded it, and the great use at once made of that opportunity.

The statistics of the operations of the committee, exhibit several alterations in the scale of admission charges, &c. These variations mark the experiments of the committee, which were doubtless made with a view to ascertain in what manner the Exhibition might be made self-supporting, on the one hand, and on the other, available to the greatest number of the least educated classes. For those classes, most certainly, the utmost accommodation ought to be provided, so as to make an exhibition so full of instruction for them, as attractive also, and agreeable as possible, that they may be induced to remain there long, and to come there often; and the committee seem, indeed, to have done all in their power to this end, by the evening gas-light exhibitions, expensive as these necessarily were. But we cannot keep expressing our own hope, that means will yet be found, (they ought to be, in fact, by direct assistance from the state, if necessary,) to give the poorer classes at least one day in the week *gratis*; at least the afternoons of Sundays and holidays, which might surely be

better spent in company with works suggestive only of pure thoughts and noble feelings, than amidst the low or meaningless and often degrading scenes to which the uneducated and poor man finds himself too often driven for amusement, under the present system of society.

We may now, without further preface, state shortly the results of the Irish Institution experiment, so far as they have been published, or we have been able to ascertain them, and we may leave them to speak for themselves:—

Visitors to the Exhibition at:—

Date, 1854.	1d.	4d.	6d.	1s.	Total.	Catalogues sold at 2d.
January ...	1,949	379	245	...	2,573	722
February ...	2,356	573	...	5	2,934	686
March ...	1,973	676	...	71	2,720	567
April ...	1,559	709	...	53	2,321	483
May ...	729	816	...	71	1,616	299
To June 17th ...	...	...	...	26	26	3
Total	8,566	3,153	425	226	12,190	2,760

NOTE.—1d. was charged in the evening by gaslight. 1s. was charged on Fridays and Saturdays, (students' days,) when only annual subscribers and strangers in their company or bearing their order, and then paying 1s., were admitted. The paintings actually being studied were the last to be packed up to be returned, and students accordingly were still admitted in June, after the close of the public Exhibition.

The Exhibition was open to the public (exclusive of Fridays and Saturdays) during 93 days, and on 75 evenings by gaslight. Of annual subscribers to the Institution there were 211 gentlemen, (at £1 1s.) and 60 ladies, (at 10s. 6d.); in all 271. The attendance of students and artists was, of course, very varying, because many attended only on Fridays and Saturdays constantly, especially professional artists, who usually attended during the morning reserved hours, on other days only to finish a picture or to make an occasional sketch. But there were in all 49 artists and students admitted to study,*—20 gentlemen and 29 ladies. The average daily attendance was 16; (it was always much greater on Fridays and Saturdays); the greatest number who had attended for study on any one day being 33.

The total amount received at the doors only realized £105 13s. 2d. for admissions and £23 for catalogues. But on the 17th June there had already been got in £210 10s. 6d. of the annual subscriptions, of which those then unpaid are gradually coming in. The accounts are not entirely made up at this moment, but they will, we understand, exhibit a total expenditure of about £340, and receipts to the amount of about £380. The expenditure will include that of returning all the works of art lent to the Institution for exhibition.

The chief support of the Institution, it is evident, has sprung from the subscriptions of the annual subscribers. These subscribers are not all in

* Professional artists were given a right of admission. Students of the R.H.A. and of the R. Dublin Society's Schools, on the recommendation of the Keeper or Head Master. All other* students and amateurs only on proving their competence to make use of the privilege by submitting some work to a committee appointed for that purpose.

Dublin; very many are residents elsewhere, indeed in most parts of Ireland, who also recognize the national value of such an establishment, and think it becomes them to support it. And this class of support is increasing, and will, doubtless, increase still more. With such experience, therefore, and with a confidence, which there is every reason to believe is well founded, in the general support they are now still more likely to receive at the hands of the wealthier classes throughout the country, the Committee have already taken active measures for the preparation of a second Exhibition, of the same class, and on the same scale, which will probably be opened in the same place about the end of October next. It is true that the many noble works which Lord Ward permitted to remain here during the past winter will no longer grace its walls; it is true that so many other gems of the past year will cease to hold a place there; but it has been ascertained that a most abundant choice of works of high, some of them of the highest merit, is open to the Committee of selection, many proprietors having already come forward in the most liberal way to co-operate in making the second exhibition fully worthy of the first. It will have the advantage too, (in the eyes of many,) of being in chief part altogether new, and we are assured of a variety in the schools and styles of the specimens to be included in it which will secure to the artist and student the same opportunities which he has enjoyed during the past six months.

The great effort of the Committee of the Institution, and indeed of all friends of the project, to secure us a National Gallery should now, however, be directed, and without delay, and with unwearied constancy, to the acquisition of a permanent Building suitable to the purpose and worthy of the country. It is now finally ascertained that the money raised by subscription to erect a public monument to Mr. DARGAN is to be devoted to this most worthy object. A public building will be perhaps the most striking memento of the great contractor, and it will certainly add no small value and honour to the building if it be erected in Merrion-square, (under the arrangements which have been so satisfactorily concluded between the Institution, the Royal Dublin Society, and the Right Hon. Sidney Herbert,—see ante, *Journal of Social Progress*, No. I.), and if it be occupied by a National Gallery under the management of the Irish Institution, of which Mr. Dargan is one of the Vice-Presidents. The amount of the subscriptions alluded to does not, however, exceed about £5,000, and a really suitable building, of a character sufficiently ornamental for such a situation, would certainly cost double that sum, and to obtain that amount will, doubtless, require the best exertions of the wealthy and influential gentlemen who form the active committee of the Institution. As the means of accomplishing this necessary object are even now under anxious consideration by the Committee, we shall not here, at present, say more than that the best course, in our opinion, would be to reserve the amount which may be raised by private exertion for the purchase of works of art for the permanent public gallery, and to insist on obtaining the requisite balance of £5,000 more from that government which yearly lavishes such vast sums (so much of which, too, are raised in Ireland) on the public buildings

of London, and which only a few years ago granted Scotland *three times the amount for the very same purpose.*

The arrangements for a permanent building will, no doubt, facilitate the acquisition of materials for a permanent gallery, while its erection in the fashionable locality of Merrion-square will probably much more than double the daily attendance of the public and the substantial support it gives. Several valuable pictures have already been presented, upon the sole condition of a National Gallery being permanently formed. Mrs. Carmichael (of Rutland-square) has contributed a donation of two marble statues after the antique. Several noblemen and gentlemen connected with the Institution, and who possess fine collections of works of art, have already intimated their intention to present in the same manner specimens of a class worthy of admission to a national establishment. The Royal Dublin Society holds more than one painting (besides the two large cartoons of RAFFAELLE) in trust until a National Gallery be established. Lastly, the funds of a society established some years ago for the purpose of forming a good gallery of Casts in Dublin have been devoted to that object, but for the proposed National Gallery, in which, of course, a collection of first-rate casts (provided they be really first-rate) will be found of the very highest importance. And thus there can now be no reasonable doubt of the eventual success of the project broached last November, even of its speedy success, *if only the erection of a building devoted to the purpose be made speedily certain.* And we are much mistaken if the exertions of those we know to be at present engaged in endeavouring to secure this desideratum will be found insufficient or turn out to be unsuccessful.

Such is the present condition and such are the prospects of the new IRISH INSTITUTION. May it strengthen and prosper in all its ways, and may it constantly enjoy such a direction as will make it actively useful in the great work of true and pure civilization.

ART. III.—*The Universal Exhibition of the Products of Industry and of Works of Art in Paris in 1855.*

IN March, 1853, it was announced that a universal exposition of the products of the Fine and Industrial Arts would be opened on the 1st of May, 1855, in Paris. The arrangements are now rapidly progressing towards completion, and the programme is being extensively circulated throughout Europe. Our space forbids us from giving that programme, for which we are indebted to the courtesy of the French Consul, in our present number, but we shall endeavour to make room in our next number for so much of it as would interest Irish manufacturers.

In the meantime, however, we would beg to impress upon all Irish manufacturers, the importance of contributing to this exhibition, for several reasons:—1st, that the honour of the country ought to be sus-

tained; 2ndly, because France contributed largely to our own exhibition; and 3rdly, because it is our interest, in a commercial point of view, to make the world acquainted with our productions. We know that it entails a good deal of trouble and expense upon manufacturers, to get up goods for so many successive exhibitions, and many, no doubt, not perceiving any immediate results to follow from their labours, are discouraged. We are confident, however, that the greater number of our manufacturers would derive even immediate benefit from contributing to the French Exhibition. Paris is not merely the capital of France, but also of nearly all Continental Europe, and the exhibition there will be visited, if not by a larger number of people, at least by a greater relative proportion of foreigners than the London Exhibition of 1851; for, strange as it may appear, an arm of the sea 50 miles wide opposes a greater barrier to the intercourse of nations than 300 miles of land. Add to this, that the majority of foreigners who are not people of fortune, have a very just terror of the expenses of travelling in these countries.

We have heard it objected, that little benefit could accrue to Irish trade by our manufacturers exhibiting at Paris, in consequence of the hostile tariff of France. Such an argument would not deserve notice, were it not urged very generally, and by persons who might influence very considerably the decision of our manufacturers. But did not the same objection apply to the French contributing to the English Exhibition, and to our own? A great number of persons confound free trade in corn with free trade in everything, and the British people take no small amount of credit to themselves, that the policy of free trade has been initiated by them. There is no doubt that free trade in cotton, woollens, iron, in fact in everything in which the geological or geographical position of England gives her superiority, exists. But is there free trade in those things in which she does not possess those advantages? Let us see as regards France. We have brass and bronze manufactures charged 10s. per cwt., which, in the case of large castings of zinc electro-bronzed, amounts to from 8 to 15 per cent.; embroidery net, &c., of silk, 10s. per lb.; cotton net, 8s. per lb.; japanned or lacquered ware, 10 per cent.; fancy ornamental articles of iron, 15s. per cwt.; common cotton pillow lace, one inch wide, £1 per lb., and exceeding 2 inches, £2; boots, shoes, &c., at least 10 per cent.; room papers, one penny per square yard, and other kinds of paper, 2½d. per lb., that is fully 50 per cent. upon the cheaper kinds; manufactures of silk, 15 per cent.; silk bonnets, 7s. each; silk dresses, £1 10s. scented or fancy soap, 2d. per lb.; brandy, 15s. per gallon; manufactured tobacco, 9s. per lb.; spirit varnishes, 12s. per gallon; artificial flowers, 12s. per cubic foot, without allowance for vacant spaces. All the articles which we have enumerated, are great and important manufactures, and belong to that class in which the French manufacturer has notoriously the advantage over the British, and hence the latter protects himself, or did while he required it. But even admitting that the duties on linen and other things were prohibitive, that is the very reason why the manufacturer, who fancies his goods are superior to the French, should exhibit them, in order to induce the latter to relax their tariff, and enjoy a better and a

cheaper article. There is nothing we know so tempting as cheapness, even quality is forgotten for it.

We are anxious, however, to qualify our recommendation to Irish manufacturers to contribute to the French Exhibition, by strongly advising them to do so *on one condition only*, namely, that all things sent from Ireland should form a distinct national collection, apart from the English and Scotch. This was not done at the London Exhibition, very much to our loss; and with shame be it told, that an Irish committee of an Irish Exhibition did not do so either, that is, forgot the true object of the Exhibition. If it was important in the two cases we have mentioned, it will be doubly important to isolate our contributions in Paris. We are not known as a manufacturing people, and our products carefully mingled up, as they would certainly be, with the immense mass of British manufactures, would attract no special attention, and if they led to any result, it would be merely to assist in bringing more customers to Leeds and Nottingham, &c.

Surely the Royal Dublin Society, instead of confining its exertions to Dublin and its environs, as it is about to do at the recommendation of the Board of Trade, ought to initiate a movement over the whole country, and the rest of Ireland ought for once to lay aside its jealousy of Dublin, and all earnestly exert themselves to secure a separate and distinct, but adequate representation of Ireland at Paris. And if the Board of Trade will not consent to send the Irish contributions direct to Havre, instead of from London, surely there is spirit enough in the country, if properly elicited, to do so itself. To this of course it will be objected, that the Commission of the French Exhibition would only treat through the Board of Trade, and that if that body did not consent, nothing further could be done. There is a class of persons who are always of opinion that nothing can be done; that these persons will follow their natural instinct in this case, we have no doubt; but we hold, on the other hand, that if the country wished it, *and that the contributions were deserving of it*, it could be done, and what is more, the Board of Trade would feel compelled to assist; but in case we were met by a refusal, the alternative of not sending at all would still remain, and our advice would be to accept it.

JOURNAL OF SOCIAL PROGRESS.

ART. I.—*On a proposed Paper Currency.*

[THE following paper on the subject of Paper Currency has been sent to us by a correspondent. We think it at least worth submitting to the public. One very serious objection to the adoption of the plan suggested, occurs to us at the outset, namely, that by throwing, as it proposes to do substantially, the whole paper currency of the country into the hands of the English government, a power would be bestowed upon that government which would be quite sure to be made the subject of jobbing, and to be otherwise abused. Moreover, so far as regards Ireland, we should be very sorry to see any measure introduced which would have the effect of checking enterprise or speculation in any department. All branches of industry require to be stimulated amongst us rather than restrained, and the business of Banking is one especially whose extension and freedom are of the highest importance to the rising industry of this country:]

It is admitted that Paper Money is one of the most refined of all the expedients to which the relations of society has given birth. It saves a portion of such costly articles as the precious metals, and thus increases the comforts and conveniences of life, by enabling them to be appropriated to purposes of ornament and of use. It facilitates exchanges between places remote from each other, diminishes risks, economises the time and trouble of large payments, proves a cheap agent, aids reproduction, by opening a wide field for the relative operations of capital and labour, while it prevents the losses sustained by hoarding and casualties, or by the attrition or debasement of coin.

At the same time paper money can only be regarded as a circulation of credit, and as coined metals were, in the progress of mankind from barbarism, substituted for barter, so, in a further stage of civilization and improvement, a paper medium has been partly substituted for coin. The essential benefit of the invention does not then consist in forming an entire substitute for the precious metals. The monetary system, to be perfect, must be composed of specie and paper, for specie, as possessing intrinsic value, universally appreciated in every age and land, must still be considered as the immediate element into which the currency of the country may at all times be resolved, and constitutes the true basis on which the fabric of paper circulation can be solidly reared. The permanency of Paper Currency can therefore only be realised by making the representation of value constantly and readily convertible into real value, immediately into

gold and silver, because these preserve more steadily than other commodities an uniform value, and form the most convenient measure of exchange, and ultimately by their medium convertible into any commodity or property of intrinsic value. From these principles, it is evident that a paper currency, convertible into specie, will answer every purpose both of usefulness and security.

But in order effectually to ensure the means of constant convertibility, it is indispensable that the circulation of paper money should be restricted to a certain fixed sum, and that the issue be regulated by a commensurate amount of assets, unexceptionably guaranteed and of an available kind. The next question to be considered is the selection of the body or department to which the privilege of issuing paper money should be entrusted.

Experience has proved that a power of such permanent importance cannot be safely confided to any executive government, and is quite incompatible with its proper functions; neither is it advisable that the grant should be conceded to joint stock banks, or private banking companies, as at present constituted, or to any one firm in particular, however large its capital or judicious its management.

Serious objections are fairly urged against unlimited issues and doubtful responsibility. The natural results of a vicious system are constantly developed in visionary speculations, depreciation of the currency, fluctuation in prices, derangement of the foreign exchanges, a run for gold, exportation of bullion, a recurrence of panics, commercial embarrassments, bank failures, and a threatened suspension of cash payments.

It may perhaps be difficult to propose a complete and effectual remedy for abuses incidental to an institution so eminently artificial, but it is comparatively easy to devise such improvements, both in the application of the principle and the details, as may obviate its most glaring defects. With this view the following plan is suggested, which appears to combine the advantages of complete security, with a free trade in banking, while the supply of the currency and the demand will adjust itself to all legitimate wants, according to a *defined scale, without undue expansion or contraction*:—

1. That an uniform description of paper money be legalized by Act of Parliament, consisting of imperial notes from one pound and above.

2. That for the accomplishment of this object on a safe and satisfactory basis, a financial arrangement be effected, with the approval and sanction of the Treasury, authorising the Commissioners of the National Debt to create "Special Debentures" for sums not less than £100, and not exceeding forty millions sterling in the total, bearing an annual interest at the rate of $2\frac{1}{4}$ per cent, and available at par, when required, on a similar principle to savings banks' liabilities.

3. That the Special Debentures be marked unalienable, and be appropriated exclusively for the use of such chartered or incorporated joint stock banking companies, or private licensed houses, as shall be disposed to invest capital in funds of this species, subject to the requisite condition of not being transferable, and of being employed solely for the purposes intended, in furtherance of the general design.

4. That the Commissioners of Stamps be entrusted with the direction, control, and preparation of the imperial notes, and that they be empowered to distribute and advance them in due proportion among the aforesaid banks in lieu of an equivalent in Special Debentures, pledged as deposit security, and committed, after registration, to the custody of the Exchequer.

5. That the imperial notes be endorsed before issue by the responsible agent of the bank to which they are supplied, that the name of the establishment be stamped on same, and that they be payable in specie on demand.

6. That imperial notes constitute a legal tender.

7. That the Stamp Office be allowed to exchange new notes for old ones cancelled, without any additional charge.

8. That the dividends on the Special Debentures be received by the Commissioners of Stamps, and that 2 per cent. annually be credited by them to the respective depositors. The proceeds of the one-fourth per cent. deduction being assigned towards defraying the increased expenses of the department.

9. That the whole of the Special Debentures, or any smaller number thereof, may, on three days' notice, be withdrawn by the original parties or their representatives, on presentation at the Stamp Office of an equal amount in value of imperial notes.

10. That imperial notes be advanced, without restriction in amount, on bullion bonded in dépôts, under precautions for its custody prescribed and ordered by the Treasury, with the like stipulations for resumption that refer to debentures.

11. That the stamp duties and the composition for stamp duties on bank notes be abolished.

12. That periodical returns be published in the Gazette, certifying the amount of imperial notes in circulation, together with an account of the *special debentures and bullion lodged by each establishment*.

An arrangement of the currency founded on these principles, would be peculiarly adapted to inspire public confidence and to gain deserved favour. The imperial notes to be issued under the proposed enactment would possess the primary elements of credit, viz., solvency, real capital, and and the resources of the state mortgaged for their security.

In determining the precise amount of imperial notes that will prove adequate, in the first instance, to the exigencies of the community, an approximation may be arrived at that will serve all practical purposes, guided by the average circulation taken for the last few years. From the statistical tables of the latest date it appears that the entire bank note circulation for the three kingdoms amounted, on January 26th, 1850, to the sum of £33,243,836, and on October 29th, 1853, to £40,646,073, on May 13th, 1854, to £39,547,291, on June 10th, 1854, to £37,780,985. Now, assuming forty millions, for round numbers, as the maximum of the special debentures, it will be found sufficient under existing circumstances, and perhaps continue unchanged for some time, until it becomes necessary, at a future period, to provide for the contin-

gencies attendant on an increase of population and the extension of commercial transactions. The position of the state as to liquidation, will be exactly similar to the savings-banks claims, which exceed thirty millions, but with the material difference in the calls for repayment, which will seldom be preferred, when the reserved notes on hand can be more beneficially expended in the purchase of exchequer bills or other temporary obligations.

The banking institutions of the country will thus be placed under wholesome restrictions, and be subjected to the salutary control of legislative interference. In direction of their affairs and the conduct of their business, they will remain quite independent of government, except in the administration of the securities. A safe, consistent, and defined mode of issue will supersede the present uncertain and imperfect system.

An arbitrary power, affecting the value of all kinds of property, will no longer be left to the discretion of parties trading with unequal means, and actuated by conflicting interests. The stability of every class of paper money being equalized and assimilated, the notes of all banks will constitute a legal tender, obviating, at the same time, the inconvenience that results from the diversified character of the varied notes of numerous banks. When the currency is restored to a sound and healthy condition, the grounds for the suppression of small notes (at all times a questionable measure) will be removed, and that strange anomaly cease, by which the one pound note circulation permitted in Ireland and Scotland, is prohibited in England; imperial notes and sovereigns will be mutually convertible, and will circulate together.

The project involves no detriment to any interest, and can be brought into operation without introducing new machinery to carry out the scheme. The just profits of banking will be rather increased than diminished by the change. A remunerating income derived from the sums subscribed, accompanied with a limited liability to shareholders, will act as an inducement to embark adequate capital in banking pursuits. The competition of rival establishments will be discontinued. Exclusive privileges and bank monopolies will cease, while banks of fictitious capital will be extinguished. The utility of silver will be extended, though the actual value of money will continue unaltered by the preservation of the existing gold standard. A liberal premium will stimulate ingenuity to contrive a plate for printing the imperial notes almost inimitable, and a perfect similarity of device will enable any person to discern the genuine engraving. Forgeries will thus be rendered more difficult to execute, and more easy to detect. The agricultural, commercial, and manufacturing interests will be protected from those sudden vicissitudes of alternate redundancy and contraction, which, originating either in ignorance, design, or caprice, produce effects disastrous to the public welfare.

In point of fact, all ranks will participate in the advantages of the proposed system of currency. Excessive speculation will be checked, steady prices maintained, foreign exchanges balanced, honest industry encouraged, and skill and enterprise rewarded, owing to the internal economy of our pecuniary concerns being regulated by that caution and foresight which

is ever found most conducive to individual prosperity and national wealth. Considered in a financial light, the reduced charge on the debentures will strengthen the sinking-fund, and the Commissioners can discharge the respective debts due to the Banks of Ireland and England.

And as the policy of renewing the Bank of England charter, which expires next year, will come under discussion in the ensuing session, a reasonable expectation may be indulged, that the collective wisdom of the legislature may, after a mature deliberation, find a solution for this perplexing problem, in a way calculated to promote the progressive improvement of the country.

ART. II.—*Sanitary Measures.—Public Baths and Wash-houses.* No. I.

A FEW years since a movement was commenced in England, at first on a very small and unpretending scale, for the purpose of supplying the working classes with bathing and washing accommodation at a moderate cost. Owing to the active exertions and real energetic philanthropy of a comparatively small number of individuals, this subject has now reached such a position of extent and importance, that any one coming to inquire into its operations will find, perhaps not without much surprise, that he has to deal with facts and figures in which money is estimated by thousands, and the numbers of bathers and washers amount to many hundreds of thousands. No more striking proof could be given of the value and general utility of any public movement.

Perhaps in no other countries is the necessity or advantage of free ablution, not to speak of bathing as a luxury, so little understood and appreciated as in Great Britain and Ireland. Even among the wealthy classes, bathing, especially the use of the warm bath, is but rarely practised in either country; while in England, the neglect of ablution among the lower classes was proverbial to such an extent as to earn for them the not undeserved title of "the great unwashed," a title which, taking into account the difference of habits and the greater facilities for bathing enjoyed by the wealthier portions of the community, was about as well deserved by them. The so-called better classes are also in no small degree chargeable with the vices of uncleanness so stigmatized amongst the lower; for that nauseous morality which pervades the civic and corporate mind, and delights in legislative *forms* of virtue and public propriety, has shut up all but the most distant and almost inaccessible parts of our river banks and sea shores from the working classes and the poor. How much would it not have contributed to the health and comfort of a large body of our fellow-citizens, if a few pounds of the public money had been spent in erecting such cheap but commodious and efficient wooden sheds, in some of the various outlets of this city, as would combine all the requirements of privacy and the most scrupulous morality! Would not this be a good and noble thing

to effect? Surely it is worthy the attention of some public body; for with but small means, almost incalculable good might be thus accomplished.

The effects of cleanliness are twofold—firstly, physical; and secondly, and we might almost say, consequently, moral; and these effects, when considered in relation to masses of men, are of immense importance, striking, as they do, at the root of many of our worst social evils.

In a sanitary point of view, the advantages of personal cleanliness are, one would think, sufficiently patent and obvious, and at least in theory they meet with almost universal recognition. But the evils which attend uncleanliness, and its various grades down to complete personal and domestic habituation to dirt, are neither so directly striking, nor so immediate in their effects, as of themselves to deter from indulgence in them. We require to be educated to a knowledge and due appreciation of what may be called the negative results of cleanliness, and this remark applies to all classes; it is not in what we shall gain directly, but in what we shall be enabled to avoid of discomfort, ill health, and actual disease, that lie the greatest advantages of cleanly habits. It is to be hoped that, with the almost universal diffusion of cheap literature, now so widely spreading, some few simple, but great and necessary principles will gradually reach the minds of the great body of the people, and there take fast and permanent root, ultimately to become an important part of the oral, traditional, domestic knowledge of all classes. Amongst the most important of these principles are those which relate to the conditions under which health may be maintained and preserved; for most true is it, that in all essential things the world has yet to learn to live. We have yet practically to learn how to use light, air, fire, water, and likewise how to feed, clothe, and house ourselves in the most simple, economic, and healthful manner. It is little to the gratification of our pride, perhaps, to admit that we are still, in this nineteenth century, so backward; however, if but that we all knew and felt this, and took boldly and courageously to the work, we could have much hope; for truly, to know and acknowledge our ignorance, and resolve to mend it, is to be wise. True it is, nevertheless, how much we have yet to learn; it would seem as if in proportion as it progressed in artificial acquisitions, too often but the semblance of a real or valuable progress, the human race had lost some of its natural instincts, which it may be supposed would have guarded it against the adoption of evil habits, at least such as are pernicious or destructive of life. Certain it is, that much of our scientific acquirements are valuable only in so far as they shew us where and how far we have gone wrong, and this often in ways so obvious, that our blindness in falling into them is only to be equalled by or compared with the obstinate folly with which we adhere to them, after they have been fully proved to be dangerous, if not fatal. With a boundless and inexhaustible supply of air everywhere around us, we have taken all requisite precautions to exclude it in its freshness and purity from our dwellings, and to retain around us that which we have vitiated and rendered unfit for our further use. We have built it in, and built it out; we have taken it hot, foul, fatid, and noisome, when we might have had it pure, cool, and life-invigorating. We have

lived in it thus impure and unfit to maintain life, after we have learned that it has mowed down more of our children than the sword of Herod, more of adults than have covered the bloodiest battle-fields.

Water lies within our reach, but is not so readily accessible as air; its uses are great and universal, but except in connection with our aliments, are not felt with a sense of imperative necessity. Yet at various times its employment in the bath has been recognized by national custom almost as a social want, and this has been, and is still, remarkably the case amongst many peoples. That its free and constant external use is more than a luxury, constituting, in fact, an essential requisite for the due maintenance of health and the avoidance of disease, we shall proceed to shew in a brief but conclusive manner.

We are taught by the anatomist and physiologist the wonderful and complicated structure of that external covering of animal bodies, the skin, and the great and important functions it performs. If we were to judge of the part played in the animal economy by the tegumentary apparatus of our bodies, according to its superficial extent, we should form but very inadequate conceptions indeed of its real uses, and the vast services which it accomplishes. It is only when we come to examine more closely into the organization of the skin that we learn to appreciate fully its purposes, and the immense importance of maintaining it in a sound, efficient, and healthy condition. Medical science has established that the great office of the skin is to provide an extensive egress for certain materials which have served their purpose in the system, and which being no longer required, must be carried out of the body through various channels, to make way for the reception of new matter which is ever being taken in from without, in the never-ceasing interchange of fresh and invigorating for old and effete elements, which constitutes one of the most remarkable phenomena of animal life. Amongst the great systems of purification provided in the body, that of the integumentary apparatus plays a most important part. Various effete matters no longer required in the animal machine, and whose further retention is injurious, are conveyed away by the skin, principally in combination with water, but also with a considerable quantity of a certain oily or fatty product. To carry to the surface these effete matters, a series of tubes, minute indeed in size individually, but in the aggregate of a truly wonderful extent, is provided in the skin, generally placed in a direction perpendicular to its surface, and running through its substance from deep to superficial. The skin may be thus looked on as the seat of a vast and great system of tubular drains, perpetually bearing to the surface, for complete elimination from the body, the now useless refuse of the wear and tear of the tissues. Without the aid furnished us by the microscope to view and examine the structure of the skin and its wonderfully perfect system of tubular drains, it is almost impossible to obtain an adequate idea of their individual perfection, and their enormous aggregate extent. We are indebted to Mr. Erasmus Wilson, an eminent physiologist, of London, who has devoted much attention to this subject, for some highly ingenious calculations, which enable us to realize practically, to some considerable extent at least, the vastness of the drainage

surface thus provided in the skin. In estimating the length of tube of the perspiratory system of the body, he takes, from the result of his own enumerations, the number of the pores, or superficial orifices of these tubes, as about 2,800, on a fair average, to the square inch, each little tube being about one quarter of an inch in length. He calculates the number of the pores for the exterior surface of the body at 7,000,000, and the number of inches of perspiratory tubes at 1,750,000, or very nearly Twenty-eight Miles of Drainage Tubes in the Skin of the Human Body; an extent almost incredible, but which enables us to realize to ourselves some notion of the vast importance of the function performed by it, and to form some idea of the immense disturbance which must be created in the other emunctory organs of the body, if any causes should operate to impede the ordinary eliminatory action of the skin and its depurating apparatus, whereby a supplementary action would be called for in other portions of the system.

The slow, gradual, and almost imperceptible manner in which this great cutaneous function of depuration is performed, renders us all but unconscious that it is taking place, and very few indeed have any definite notion of the amount of fluid matter thus conveyed out of the system. Were just views on this subject more generally and popularly entertained, it cannot be doubted that more efficient means would be taken by every individual to preserve in a state of rational and healthy action a function so important to the health and the general well-being of our persons. To realize to ourselves an idea of the amount of perspired fluid exhaled by the skin, we may refer to the well-known statements of Lavoisier and Seguin, who calculated that about eight grains of matter are given off per minute, which amounts, in the twenty-four hours, to somewhat like thirty-three ounces, or more than two pints, *giving for the daily amount of drainage and depuration by the skin an average of one quart.*

We shall not enter here into any more detailed examination of the nature of this great perspiratory function, which would be neither within our province nor requisite for the purpose we have in view. It will be sufficient to say that, besides water, the perspired fluid contains nearly one per cent. of refuse, comprising animal matter, gases, alkaline, earthy, and metallic salts, and sulphur compounds. Other very important offices are likewise fulfilled by the cutaneous perspiratory system, such as that of regulating the temperature of the body, and the quantity of fluid in the tissues, &c.; but the most important, and that which is of chief interest in relation to our present object, is that of drainage and depuration, which we have, in the statement above given, attempted to realize to the mind of the reader. The extensive tubular apparatus subservient to the process of cutaneous drainage is, from the minuteness and delicacy of its structure, very liable to obstruction and clogging of the materials passing through it. Each minute tube is itself furnished with a lining of still much minuter structure; its interior being invested with an exquisite tile-work or coating of minute bodies, termed "cells" in the language of anatomists; these little cells are being constantly thrown off to make way for new ones, and the debris thus formed, mingling with the matter passing through the tubes, will, it may

be readily conceived, soon clog and fill it up if any obstacle be presented to free egress at the external orifice on the surface of the skin. The superficial layer of the skin likewise is composed of small scale-like bodies or "cells," which are ever undergoing renewal. This debris of the worn-out elements of the tubes and the skin would, if not removed, be in itself sufficient to impede the action of the perspiratory apparatus; but when mingled with the unctuous materials of the perspiration, and thus allowed to accumulate, it forms a sort of universal adhesive glaze or varnish, to which all extraneous particles adhere: the products of the wear and friction of clothes, dust, the infinitesimal and hence most pernicious dirt of all objects that come in contact with our person, the thousand invisible impurities that are carried about in the atmosphere, especially in that of cities and large towns, all are attracted to and precipitated on this adhesive animal glaze, to increase, and thicken, and crust, and clog, and effectually dam up the orifices of this exquisite tubular system of cutaneous drains, fashioned with such wonderful skill and care, and capable of such high efficiency of action.

This great office of depuration cannot for any long period be impeded without detriment to the system; for a time the supplementary action of other organs will prevent the results being manifested in any very inconvenient manner or degree (nothing is more marvellous than the tolerance of ill treatment which the system exhibits), but sooner or later some overworked organ begins to suffer, and disease or sickness, of one kind or another, of the system at large, or of some particular part of the machine, proclaims itself. Nothing is harder than to convince people that sickness and disease are often, very often, the result of neglect of simple precautions, of obvious and almost flagrant errors, of the neglect of means almost speakingly dictated to us by nature to aid in or complete what is in greater part effected for us without the necessity of consideration on our own side. And well it is that so little is left to our care and charge, of the machinery that constitutes what is physical of us. It is a curious matter for reflection how much we have lost of instinct in the cultivation of intellect and the prosecution of artifice; but it is unquestionably true that no animal takes worse care of the body entrusted to him than man.

We have attempted only a very general and imperfect description of the *rationale* of one of the great physiological processes perpetually going on for the depuration of the animal system, and glanced at the way in which neglect of the simplest precautions impedes, and finally obstructs its action, which constitutes, in fact, the *rationale* of the injurious effects of personal uncleanness, and dirtiness, and neglect of person and habits. To any who have given even a little attention to this subject, it would be unnecessary to urge these or any other arguments in favour of a universal revolution in the modes of life which perpetuate these evils and their results, in all classes of society, but more especially among the lower. But few indeed, however, have given to these matters the consideration which they deserve, and very erroneous opinions are still widely in circulation. The various results, so fatal to the health of the community, which ensue from the neglect or ignorance of what are in reality but the A B C of sanitary

principles, are produced by causes acting slowly, though not less surely—silently, but not less widely—and mortally, though not in a manner to strike or appal the inobservant. Experience, however, and the more conclusive results of close and accurate investigation, have now shown, in a manner capable of satisfying all who will take the trouble to examine into the proofs, that impure air, bad ventilation, neglect of household cleanliness, stagnation of water, and other similar influences, are directly fatal to human existence.

Many are satisfied with a general undefined belief in the value and importance of sanitary improvements; such things have, in the present day, acquired a certain kind of fashionable vogue, but very few indeed realize to themselves ideas which amount to any thing like a well established conviction of their utility, and fewer still of their absolute necessity. It is believed to be philanthropic, and “all that sort of thing,” to “ameliorate” the condition of the working classes, but hardly any see how improvements effected in the sanitary conditions of the working classes, and of the poor and desolate, are intimately related to the preservation of their own health. And yet it is not the less true, that the health of the upper classes is largely affected by that of the lower. Disease which has originated in the squalid huts of poverty, gaining strength and concentration in the crowded and filthy, ill-ventilated and ill-drained lanes and alleys of the poor, soon strides beyond the centres, in which it has for the hundredth time been again fanned into a flame, from its ever smouldering, but never extinguished embers; and thus periodically called into activity, its course is not to be stayed by the artificial distinctions of rank; for most truly may it be said that, in disease as in death, we are all brothers. Fever that has been fed to the strength of contagion in the loathsome and damp straw of the destitute, will steal through the silken curtains of “my lord’s” state couch, and lock him fast in its embrace as he lies on his pillow of eider-down, for surely, if it but “come betwixt the wind and his nobility,” it will spare neither him nor his fellows nor his neighbours, be they high or low. We may cite in relation to this view of the subject the following passage, bearing the stamp of medical authority:—

“In all the interests of the State there is not one of more paramount importance than that of the public health, not one which more deeply affects the general and individual relations of our social existence. The health of the public is therefore a public care, a public trust, its conservation a public duty; and when these principles come to be fully recognised and acted on, we are convinced that with the accumulating aids daily furnished by scientific medical research, much can and will be accomplished towards the further mitigation of human suffering, the arrest of contagious disease, and if not the prevention, at least the partial stay of epidemic ravages. How little has ever yet been attempted towards the accomplishment of these great ends on any large comprehensive system, with any principle of combined action, or with any definite and determinate views! As if the direct scourge of God, disease goes abroad from the hovels of the poor to invade the luxurious dwellings of the rich, ranging through all the intermediate social grades; and thus ever multiplying its centres of radiation, the wonder ceases to be that we have so much of fever and other similar maladies constantly rife amongst us; but it is, on the contrary, matter of surprise that they are not always present in an epidemic form.”*

* *Medical Times and Gazette*, May 6th, 1854.

Lord Palmerston recently stated in the House of Commons that "he could assure hon. members, that if they were to read the accounts which it had been his lot to read, as to the condition of some towns in this country, even at the present moment, they would be surprised, not at the recurrence of a periodical visitation of disease, but that the population was not extinguished by perpetual disease. For instance, the condition of Newcastle in the north, and Dartford in the south, were really things that made one shudder to think they could exist in a civilized country." Again, the officers of the Board of Health state, in their report to Parliament, that more than half of the labouring classes live in dirty and ill-ventilated dwellings; and as the result of their inquiries, they further affirm that "the *annual* loss of life from dirt and bad ventilation is greater than the loss from death or wounds in any wars in which the country has been engaged in modern times." These are strong and forcible ways of viewing the subject, but yet we think that by none have the relations we have shewn to exist between the state of health of the poor and that of the rich been sufficiently recognised. It is, however, not the less true, that this connexion is as immediate as its results are fatal. So, while we "ameliorate" the poor and the working classes, let us not forget that we are most wisely consulting for the health and physical welfare of ourselves and those most dear to us.

We fear that it will be long indeed before the English legislature will be induced to take a large and vigorous part in furthering sanitary measures, commensurate with the evils to be combated, as they are here depicted. Meanwhile a movement which originated in the true and earnest philanthropy of a few private individuals in England, has already acquired an extension which not even the most sanguine could have anticipated; and so far as may be at all practicable, it is to be hoped that we in this country will profit by such a good example. This movement has been first directed with no inconsiderable judgment to some of the most pressing public wants. We have already noticed the very successful results which have attended the exertions of the committees established to improve the lodging and house accommodation for the working classes in several cities in England. The subject of baths and wash-houses is one of scarcely less importance, and a most encouraging amount of success has attended the efforts which have been made to establish them in London, Liverpool, and many other English cities. We have already said enough as to the great advantages of cleanliness, and the evils which ensue from neglect in this particular. Personal and domestic uncleanness are only second to such causes as foul air, bad ventilation and drainage, in the production of disease, and consequently any measures to counteract its influence, deserve the next place in our consideration, after we have endeavoured to banish the latter from the homes of the poor.

But it is vain to preach to the poor and the working classes the necessity of cleanliness, when they have not the means to be clean. The reproaches which have been cast on them for neglect of cleanliness are undeserved, whilst cleanliness continues to be a luxury too dear for them to pay for, and far beyond what they can afford to give for it, either in money or in time. "Water is cheap," cry the rich, who revel in the luxury of a domestic bath-

room, and in suits to change at will. So far, however, from this being true, water in any quantity sufficient for even one proper ablution of the poor man's soil and toil-begrimed person, is dear beyond what he could pay for it. How shall he get it? How shall he, in his narrow room, with scarce one requisite utensil, procure the means of using it effectually? Will you ask him to fetch it for himself after his hard day's work, when he returns to his supper, weary and well tired, with twelve or fourteen hours' waste of his muscle and bone? Perhaps you will ask his poor sickly wife, cooped up all day in a three-pair back-room, that looks on a wall not five feet distant, and which is "aired" by windows that open on a reeking cesspool*—perhaps you will ask her, we say, to fetch it for him. Do you know that she may have carried him his breakfast and his dinner some mile or two, each way, there and home, that very day? Do you form any clear notion of how much water would be requisite for one good wash from head to foot—any thing less is of little or no use—for a smith, a mason, or a hodman, not to talk of many other occupations, from chimney-sweeping and coal-heaving upwards? The general allowance per bath for each individual in the London baths and wash-house establishments, is from 45 to 50 gallons. Now take even half this quantity, say 25 gallons, and suppose that our honest friend, the smith or mason, shall wash only once a week, which is far below what would be necessary for him to keep his body free from the necessary soil of his trade, and the foul crust of bodily sweat and refuse of his animal tissues, and the dust and dirt from all possible quarters, which will have glazed him over after even one day's hard work. Now, will you have the conscience to ask him to drag 25 gallons of water from the nearest fountain, which may be in reality a long street or two off, and then, still worse, toil with it, pitcher by pitcher-full, up his three flights of dark, narrow, break-neck stairs. If you will not ask the strong man himself to do it, we don't do you the injustice of supposing that you would ask his wife, who certainly either has a baby at arms, or is but now after or shortly before her confinement; or, (as we have only too often seen,) you may observe that she coughs and pants, and stops for breath at the first landing of the steep stairs, and has a faint red tinge that comes and goes on her otherwise pale cheek: all which a well informed doctor would say was not unconnected with the three-pair back-room, and that same window that looks on the wall, and lets in, for change of air, what it had much better keep out, the odoriferous pest-bringing breath of the cesspool below. Then even if he (the smith) accomplished to bring to his room this 25 gallons of water, and, mark you, we make no account here of the washing of his wife and children, what is he to do with it? How will you have him to use it. The biggest washing-tub that his wife steams her weak lungs over, inhaling the vapour of soil, and soap, and suds, all commixed, cannot serve him now. And even suppose he did contrive to use it, in some way or other, what is he to do with the refuse water? Will you have him to carry it all back again in pitcher-fulls? Now you see it would be hard for the smith to wash himself even *once* a week. It would shock your modesty and strict

* The writer but faintly pictures what he has known and has himself seen.

sense of public propriety, to let him bathe in the Dodder or the Tolka, the river, or even the sea, unless he goes to almost inaccessible distances; and you confess you do not see much chance that the Corporation would give the few deal boards and scantling we talked of. And this same river bathing, even if we got it, would only answer for a few summer months; and moreover, coal and soot, smithy ashes, and such like, will hardly give way to merely *cold* water ablutions. Perhaps you will now even admit that, as things stand—or, thank God, we may almost begin to say, *stood*—it is next to *impossible* for the workman or the labourer to wash and clean himself effectually from the grime of his toil. But then you will say, “Oh! even if the water were brought to them they would not use it;” “they are dirty by nature, and they love dirt; and you know it, and have had experience of it over and over again; and especially the Irish love dirt.” The *Times* proved this and many other things of a similar kind long ago, and many a time and oft since, and “it’s no use talking of such things here.” The Irish would rather stay at home, you say, and wallow in their dirt, it keeps them warm; and perhaps you are a half educated as well as well dressed and clean Irishman yourself, and you quote Horace for us, and tell us flippantly, “*Naturam expelles furcā, tamen usque, &c.*,” you know the rest.”

Now, that the poor and the working classes love and wish for cleanliness, and will avail themselves gladly of any means offered to them for bathing and washing, has been, as we will presently see, most triumphantly proved, by the eagerness with which they have everywhere flocked to the baths and wash-houses. And if results proportionately as great have not attended the first efforts to introduce them here, depend upon it, the fault lies not with the people, but in some anomalous mode of working the baths, or some obstacles or difficulties that perhaps may not be apparent to you, but which, nevertheless, are in themselves calculated to prevent the people from availing themselves of the baths, and thus to impede the success of these excellent institutions. If you will but remember your own sensations, and consider that all men are made like you, you will understand that in the nature of things the very luxury of bathing and cleanliness induces to their universal adoption, if placed within our reach; and that such an influence, all other things being equal, should prevail here as well as elsewhere is only natural; so the case for the poor and the working-classes’ love of cleanliness *versus* love of dirt, being proved in any one place, it may be fairly taken for granted for any other. If any one can be really in earnest in professing scepticism on this point, after the multiplied proofs which have been furnished of the ready dispositions of the working people to improve their condition in every possible way placed within their reach, we must treat him as one actuated by insensate prejudice or wilful obstinacy.

We must defer till our next number the further continuation of this subject, and the details of the results obtained in the working of the English baths and wash-houses.

ART. III.—*The Universal Exhibition of the Products of Industry and of Works of Art in Paris in 1855.*

GENERAL REGULATIONS.

[In our last number we promised to give the portion of the programme of the coming Exhibition, issued at Paris by the French Government, which more immediately interested our manufacturers. As it contains so much information, which it is desirable should receive as wide a circulation as possible, we intend to publish the whole of the General Regulations, inclusive of the admirable system of classification which has been adopted, and upon which we shall have some remarks to make at a subsequent period. Its length will compel us to divide it, and accordingly we give a portion of it in the present number, and we shall give the remainder in our next.]

GENERAL ARRANGEMENTS.

Art. 1.—The Universal Exhibition, appointed to be held at Paris in the year 1855, will receive the agricultural and manufacturing products as well as the works of art of all nations. It will open on the 1st of May, and will close on the 31st of October of the same year.

Art. 2.—The Universal Exhibition of 1855 is placed under the direction of the Imperial Commission, nominated by the decree of the 24th of December, 1853.

Art. 3.—In every department, a committee nominated by the Prefect, in accordance with the instructions of the Imperial Commission, will be charged with the necessary measures for the success of the Exhibition, and with the admission and rejection, in proper time, of the articles presented. There shall also be appointed, should the Imperial Commission deem it necessary, local sub-committees or special agents, in every town and centre of industry, where the necessity of them may be felt.

Art. 4.—Special instructions will be addressed, in the name of the Imperial Commission, to the Ministers of War and Marine, for the exhibition of the products of Algeria and of the French Colonies.

Art. 5.—The various foreign Governments will be invited to appoint, for the examination, selection, and transmission of their natural products, committees, the formation and composition of which should be notified as soon as possible to the Imperial Commission, in order that it may immediately place itself in communication with such committees.

Art. 6.—The departmental committees, as well as the foreign committees authorized by their respective Governments, will correspond directly with the Imperial Commission, which will not hold any correspondence whatever with the exhibitors themselves, or with other private persons, either French or foreigners.

Art. 7.—Such French subjects or foreigners as intend exhibiting, should apply to the committee of the department, colony, or country which they inhabit. Foreigners residing in France may apply to the official committees of their respective countries.

Art. 8.—No article will be admitted to the Exhibition, if not sent with the authorization, and under the seal of the departmental or foreign committees.

Art. 9.—The foreign and departmental committees should make known, as soon as possible, the presumed number of exhibitors in their division, and the space which it is supposed they will require.

Art. 10.—On receipt of that intimation, the Imperial Commission will, without delay, proceed to the division of the general space amongst France and the other countries, in proportion to the demands sent in.

Art. 11.—When that division has been effected, notice of the same will be immediately sent to the French and foreign committees, who will then have to subdivide the space thus allotted to them amongst the exhibitors of their divisions.

Art. 12.—The list of the exhibitors who are admitted must be sent to the Imperial Commission, by the 30th of November, 1854, at the latest.

These lists ought to mention:—

1st. The names, christian names (or name of firm, profession), and address of the parties applying.

2ndly. The nature and number, or quantity of the articles which they desire to exhibit.

3rdly. The space which they require in height, width, and depth.

These lists, as well as all other documents coming from foreign countries, ought, as much as possible, to be accompanied by a translation into French.

ADMISSION AND CLASSIFICATION OF PRODUCTS.

Art. 13.—All the products of Agriculture, Manufactures, and Art are admissible to the Universal Exhibition, with the exception of those included in the following categories:—

1st. Living animals and plants.

2ndly. Vegetable and animal substances in a fresh state and of a nature liable to be spoiled from keeping.

3rdly. Detonating substances, and, in general, all such as may be considered dangerous.

4thly. And, finally, such objects as, by their bulk, do not come within the scope of the Exhibition.

Art. 14.—Spirits or alcohols, oils and essences, acids and corrosive salts, and generally bodies easily inflammable or of a nature to lead to a combustion, will only be admitted to the Exhibition when contained in solid and perfectly closed vessels; the owners of such articles, will, besides, be bound to conform to such measures of safety as may be prescribed to them.

Art. 15.—The Imperial Commission will have the right of excluding, on the proposition of the competent agents, such French objects as may appear to it injurious or incompatible with the object of the Exhibition, and of diminishing those which have been sent in excess of the requirements or accommodation of the Exhibition.

Art. 16.*—The objects sent for Exhibition will form two distinct divisions: *Products of Industry*, and *Works of Art*. They will be distributed, for each country, into eight groups, comprising thirty sections, viz.:—

FIRST DIVISION.—PRODUCTS OF INDUSTRY.

1st Group.—*Industrial pursuits having for principal object the extraction or production of raw materials.*

1st Class. Mining and metallurgical products.

2nd „ Every thing relating to the management of trees, or to hunting, shooting, and fishing, and products obtained without cultivation.

3rd „ Agriculture.

2nd Group.—*Industrial pursuits having specially for object the employment of mechanical power.*

4th Class. Machinery in general, as applied to industry.

5th „ Special machinery and apparatus for railways, and other modes of transport.

6th „ Special machinery and apparatus for workshops.

7th „ Special machinery and apparatus for the manufacture of woven fabrics.

* A document entitled *System of Classification*, and specifying the divisions of the various branches of manufacture, and of Art, of their raw materials, their mode of manufacture, and their products, according to the thirty sections established in this article, will be published hereafter.

3rd Group.—*Manufactures specially based on the employment of physical and chemical agents, or connected with the sciences and instruction.*

- 8th Class. Arts relating to the Exact Sciences and to Instruction.
- 9th " Manufactures relating to the economical production and employment of heat, light, and electricity.
- 10th " Chemical manufactures, dyeing and printing, paper, leather, skins, india-rubber, etc.
- 11th " Preparation and preservation of alimentary substances.

4th Group.—*Industrial pursuits specially connected with the learned professions.*

- 12th Class. Hygiene, pharmacy, surgery, and medicine
- 13th " Naval and military arts.
- 14th " Civil engineering and building,

5th Group.—*Manufactures of mineral products.*

- 15th Class. Steel and its products.
- 16th " General metal works.
- 17th " Goldsmiths' work, jewellery, and bronzes.
- 18th " Glass and pottery.

6th Group.—*Woven Fabrics.*

- 19th Class. Cotton manufactures.
- 20th " Woollen and worsted manufactures.
- 21st " Silk and velvet manufactures.
- 22nd " Flax and hemp manufactures.
- 23rd " Mercer, hosiery, carpets, embroidery, lace of every kind, gold, and silver fringes, etc.

7th Group.—*Decorative furniture and upholstery, millinery, industrial design, printing, and music.*

- 24th Class. Industry applied to furniture and decoration.
- 25th " Articles of clothing, objects of fashion and fancy.
- 26th " Drawing and modelling applied to industry, letter-press and copper-plate printing, photography.
- 27th " Manufacture of musical instruments.

SECOND DIVISION.—WORKS OF ART.

8th Group.—*Fine Arts.*

- 28th Class. Painting, engraving, and lithography.
- 29th " Sculpture and die-sinking.
- 30th " Architecture.

RECEPTION AND PLACING OF GOODS.

Art. 17.—The various objects, both French and foreign, will be received at the Exhibition Palace, from the 15th of January to the 15th of March, 1855, inclusive. Nevertheless, a supplementary delay will be accorded for such manufactured articles as are likely to suffer from being too long packed up, on condition that the arrangements necessary for their exhibition shall have been made beforehand. That delay cannot in any case extend beyond the 15th of April. Heavy and cumbersome articles or any others, the placing of which would require considerable labour, must be sent before the end of February.

Art. 18.—The committees of each country and of each French department are requested to send as much as possible of the products of their divisions in one consignment.

(To be continued.)

JOURNAL OF SOCIAL PROGRESS.

ART. I.—*Sanitary Measures—Public Baths and Wash-houses.* No. II.

As we have shown in our last number how impossible complete and effectual bathing and washing are in the workman's home, we must bring into play the great principle of association, and provide public baths on such a scale as will give accommodation to many, and at such a charge as shall place them readily within the reach of all. The great experiment, which has been now for a considerable time tried in England, shows us satisfactorily, and with all the encouragement of successful example, how this may be accomplished, and we now proceed to give a brief sketch of the history and present position of the public baths and wash-house movement. The honour of the initiation in this movement is due to the citizens of Liverpool. In the year 1842, some benevolent individuals represented to the corporation of that town the great want experienced by the middle and labouring classes of any adequate accommodation for bathing and washing. With a liberality and zeal which cannot be too much commended, when we consider the opinion at that time all but universally held with regard to the incurable vices of sloth and uncleanness amongst the poor, it was determined to try what could be effected towards furnishing them with bath accommodation at a cheap rate, and it was in that city accordingly that the first bath and wash-house for the poor was established. "As in all similar cases," remarks Mr. Hawes, himself a true and earnest philanthropist, "the first was a cautious step, carried out under great opposition, and at a great expense, in proportion to the accommodation provided; but its success satisfied its promoters, the receipts paid the current expenses, and this being established, another and larger building was projected and executed, and still a third and a fourth." This admirable example was soon followed in London, and an experimental establishment was erected by a few private individuals at their own expense in the Refuge for the Destitute, in Glass House Yard, East Smithfield, where an imperfect and rude apparatus was provided; but such was the anxiety of the poor to avail themselves of the accommodation afforded, that within the first twelve months there were 27,662 bathers, 35,480 washers, 4,522 ironers, the number of articles washed exceeded 250,000; and all this was accomplished for less than £600.* The subject now began to assume a considerable degree of im-

* We are indebted for this and several other statements to Mr. Hawes's very admirable lecture delivered at Stratford, from which we quote nearly verbatim.

portance, and a public meeting was convened at the Mansion-house, London, in October, 1844, at which many persons of rank took part in the proceedings, and a great interest in the undertaking was evinced by all parties. Animated by the apparent enthusiasm of this meeting and the hope of extensive support, operations were commenced for the erection of baths on a very large scale. But, as might have been anticipated, there was no realization of the expectations of extensive support from those animated by ephemeral enthusiasm, and the shallow philanthropy that loves to see the civic vulgarity of its inglorious name, even for the fleeting hour of a morning paper, in contact with the titles of a noble patron, or any of the lesser lions of the day. When will the English, and much more the Irish public, learn to rely on the good and the real in the work they take in hand, and abjure the unsubstantial and the sham that is blazoned forth in the gaudy array of "Most Noble" and "Right Honorables" that figures in the title pages of every society's prospectus? How unreal this system is, the experience of every such society or association fully proves, and yet we *will* have the *cloud* of titles to obscure our wits. The instance in question is not less forcible than others; large debts were incurred, and but for the munificent subscriptions and advances of the really philanthropic, the buildings must have been abandoned. Nearly £12,000 was thus raised by little more than twenty individuals; amongst these must be mentioned Queen Victoria and Prince Albert, who subscribed £650, the Gurneys £1,000, the Rothschilds over £700, Sir H. Dukinfield, Lord Overstone, Mr. A. Smith, Mr. Hawes, Mr. Bullar, Mr. Piper, the contractor, with some banks and city companies, from £500 upwards each, while Mr. Baly the engineer, and Mr. Cotton, furnished each over £1,300. These are splendid examples.

Public attention was now thoroughly roused to the importance of this movement, and in the year 1846, the Rev. Sir Henry Dukinfield obtained an act to encourage and facilitate the establishment of baths and wash-houses throughout the kingdom. This act was in the following year amended; the first act was extended to Ireland, but owing to some strange omission on the part of those who ought to have had a more lively interest in such matters, the subsequent act was not. Several cities in England soon followed the example of London and Liverpool, and both before and since the passing of the act, established baths on a more or less extensive scale. Birmingham subscribed £6,500; Manchester, Wolverhampton, Coventry, Plymouth, Chester, Preston, Sunderland, Bolton, Bath, Bristol, Leeds, Newcastle, Macclesfield, Oxford, Maidstone, Exeter, Rotherham, Colchester, South Shields, and Hull, have also founded baths. In Scotland £2,000 was subscribed; in Edinburgh and in Glasgow the working classes joined in subscriptions, and we note this as furnishing an example of a principle of the best possible kind, which should be more generally adopted; indeed we feel satisfied that all the more independent workmen would readily subscribe in proportion to their means, and this freely and liberally, if the nature and object of the movement were explained to them. In Ireland bathing establishments already exist, one in Belfast and another in Dublin. The French government appointed a

commissioner to inquire and report upon the public baths and wash-houses in England, and in consequence of the favourable statements of the commissioner, 600,000 francs were voted by the late National Assembly to assist in the promotion of such institutions in France; and a scheme was set on foot for erecting fourteen establishments in Paris, at an estimated cost of 2,000,000 francs. The municipal authorities of Venice projected a system of baths at a cost of £33,000. Plans were furnished by the London committee to the government of Norway for the erection of baths at Christiana. A subscription was opened at Copenhagen for the same purpose. The Belgian government, and the authorities at Hamburgh, Turin, Munich, Amsterdam, Lisbon, and New York, have also taken up the subject. It is in London, however, that this great sanitary measure has assumed a magnitude and importance of the highest example, as fully shewn in the publications of "The Committee appointed to promote the establishment of Baths and Wash-Houses for the labouring classes." * More generous spirit and more true philanthropy than have been shown by this committee's proceedings, we have never known in any similar body; without the slightest consideration of expense, and with infinite cost of time and talent, they have procured the best possible plans, and devised the best modes of conducting baths and wash-houses in all their practical details, and these results they most liberally communicate to all who ask for information, whether English or foreign. Too much praise cannot be awarded to the disinterestedness of the able and talented engineer, Mr. P. P. Baly. To understand fully the working of the system, as now conducted in London, the valuable report of Mr. Baly must be studied; we propose, however, to make a few extracts from it, illustrative of the most essential requisites in such institutions, and of some of the great practical difficulties which have been successfully solved.

The third institution opened in London was the Committee's Model Establishment in Goulston-square, Whitechapel, which was completed in July, 1847. The committee, satisfied from practical acquaintance with the working of the apparatus of many establishments then in existence, that there were great defects in many parts of it, determined to obtain a remedy, if possible, and by experimental trials, and much cost of time and talent, succeeded, in several instances, in a most marked and effectual manner. The expense of fuel had been a very large item; heating 1,000 baths by the apparatus then employed, required an outlay of 75s.; the cost for the same number of baths has been reduced in the Model Establishment, to about 24s.; and it is stated that even this has been lessened. But a still more important difficulty remained to be overcome, in connexion with the washing department, namely, the difficulty of drying the clothes within a reasonably short period after they were washed. It was felt as

* We take this opportunity of expressing our grateful acknowledgments to Mr. George Woolcott, the able and most obliging secretary of the committee. The office of the committee is at 12, Buckingham-street, Aldelphi, London; and their admirable report, by the engineer, Mr. P. P. Baly, C. E., in 40 pp. 4to., accompanied by five coloured plates and most valuable information, with plans and estimates, may be had of EFFINGHAM WILSON, Royal Exchange, price 4s. 6d.

a very great hardship, that the poor women after having washed their clothes, should be obliged to wait hours to have them effectually dried and in such a state that they could convey them home. This period of delay is intolerable to the workman or labourer's wife, who has so many domestic duties, including the care of her children, to attend to, and which call for her presence at home. Had not a remedy been found for this defect, it is to be much doubted, whether this department of the institution, which really contributes as much to the comfort, cleanliness, and healthiness of the workman's home, as the bath effects for his person, could have ever been largely adopted by the industrious classes. But thanks, again, to the exertions of the London Committee, the difficulty which at first appeared almost insurmountable, and which the French Commissioners conceived would be probably fatal to their success, has been most triumphantly surmounted; the clothes may now be dried within from twenty to thirty, or forty minutes, and that in the most complete and effectual manner. This system of drying was suggested, we are informed, by the Deputy Chairman, Mr. William Hawes. The objects to be obtained, were, as stated by Mr. Baly, firstly, rapidity of drying, so that the poor women need not after the completion of their washing, wait long for their clothes to dry; secondly, the greatest economy in the apparatus, and in the fuel used; and thirdly, separation of the clothes of the different washers, to prevent theft, and to avoid unpleasant comparisons. The chief modes of drying previously in use, however modified, consisted in exposing the clothes in a chamber to currents of heated air, for raising the temperature of which various plans were employed; they were all found objectionable, either by reason of the time required, or the impossibility of separating the clothes. Great objections likewise existed on the score of the great cost of apparatus in any of the efficient modes of drying; but the loss of time to the poor was the great and paramount difficulty. The plan of the London Committee consists in constructing a chamber, which shall admit no ingress of air; in this the clothes are exposed to the direct radiation of the heat, which is absorbed by the water in the articles to be dried, and which is thereby converted into steam, and is, in this form, allowed to escape by a valvular apparatus, its own elasticity being sufficient to expel it from the chamber. The surface from which the caloric radiates, may be heated either by a fire passing through a large iron flue, through a brick flue, covered with iron plates, or by a stream of hot water, at high pressure, constantly circulating through iron pipes. The system appears admirable in all respects: when the thermometer, which sinks on the introduction of cold wet clothes, rises again to 220° or 230° , the fire is damped, for water cannot exist as such at these temperatures, and it has been all converted into vapour, which has found its way out through the valves, and the clothes are now dry. In some of the more recently constructed wash-houses, the clothes are dried in a small chamber, placed close to the wash-tub, thus securing the greatest possible economy of time, and what is of not less value, the complete separation of the different lots of articles. At a temperature of 230° degrees and upwards, which can be readily and cheaply obtained by the apparatus now in use, the clothes are dried in a

period of from 15 to 35 minutes. But the saving of time, though in itself of permanent importance to the poor, is not the only advantage thus gained; clothes dried at a low temperature, are found to have a most disagreeable, heavy, and impure smell; when dried at the higher temperature, however, it is found that they have a pure and sweet smell; they are also deprived of all infectious properties, and vermin, with their ova, which often survive the action of boiling water, are completely destroyed by an elevated dry heat. In fact, in no other possible way can such a thorough purification of clothes, including perfect sweetness of smell and good colour, be secured. Expeditious as this process is, there seems reason to hope that time may ultimately be even still more economised by improved apparatus. In the July number of the *JOURNAL OF INDUSTRIAL PROGRESS*, (No. VII., p. 211,) we noticed the use which is made of the centrifugal machine for drying clothes in the great Hotel St. Nicholas, at New York. A combination of the centrifugal principle, with the valvular heated air chamber of Mr. Baly, may be found practicable, and if so, we should expect the drying to be accomplished in an extremely short period. Indeed we think the whole of the American process for washing, bleaching, and drying alluded to, might suggest some improvements in washing-house arrangements generally, and we would accordingly recommend it to the notice of those immediately connected with the management of some establishment.

Nothing can be more satisfactory than the results of the working of the English establishments; profits of a considerable amount have been realised in several instances; by the Official Report of the St. Martin-in-the-Fields' Establishment, for 1851, the net profits for the year were £1,000. Mr. Baly states, (p. 38,) that the experience of the committee has established it beyond a doubt, that public baths and wash-houses, if properly constructed and managed, in accordance with the economical principles now adopted, will not only repay the working expenses, but will ultimately realise a considerable profit; thus, as he well remarks, satisfying at one and the same time, the desire of the philanthropist and the requirements of the political economist. Such is the basis on which this great social movement must ultimately rest, if we are to hope that it is to become a real permanent and practical thing in the daily lives and habits of the people, long after the first burst of enthusiasm and the ephemeral philanthropy of fashion shall have passed away. Such is the basis we have already strongly advocated for a similar movement, that of the Improvement of Dwellings. These are all great public wants; the working-classes are becoming daily more and more sensible that they are wants, and they are ready to pay for them. To have proved this, and to have shewn by experience that to furnish the means of supplying these wants, is a good, safe, and profitable investment for money, will be ever the indisputable claim to the civic crown of the philanthropist who commenced this great movement.

The following returns will shew the vast operations of some of the chief Bathing Establishments in London and other English cities; the statements and figures are from Mr. Woolcott's Report to the Committee:

"Return for the Year ended December 31st, 1853.

Name of the Establishment.	Number of Bathers.	Number of Washers.	Total Receipts.		
METROPOLIS.			£	s.	d.
1. The Model, Whitechapel	156,110	42,589	2,976	7	8
2. St. Martin-in-the-Fields,	155,418	46,337	3,007	5	10
3. St. Marylebone	155,827	37,061	2,498	2	3
4. St. Margaret and St. John, Westminster	111,392	66,644	2,204	12	5
5. Greenwich	61,782	8,815	995	11	4
6. St. James, Westminster	111,870	35,829	2,038	10	11
7. Poplar	41,490	10,714	845	15	10
8. St. Giles and Bloomsbury (<i>opened June 30th,</i>)	83,810	21,051	1,546	3	0
Totals	877,699	269,040	16,112	9	3
COUNTRY.					
Liverpool—					
Cornwallis-street	98,460	...	1,561	3	2
Paul-street	44,747	11,480	787	4	4
George's Pier Head (<i>opened May 11th</i>)	45,243	...	1,684	5	6
Hull	52,142	7,579	612	8	7
Bristol	40,262	11,068	599	11	2
Preston	29,296	10,376	405	10	5
Birmingham	98,396	5,547	1,854	14	5
Maidstone	31,221	5,773	348	8	10

"The Return does not include the bathing and washing at the George-street and the Lambeth establishments, which are not regulated by the public acts.

"In former Reports it has been shown, by returns of the numbers of bathers and washers, how every year has afforded increasing evidence that the working classes appreciate these institutions.

"It was anticipated by some that, when the public mind should become alive to and interested in a measure of such great practical value, thousands would resort daily to the public Baths and Washhouses; but many refused to believe that, in so short a time, and with so many drawbacks and hindrances, the success of the movement would be so marked.

"It is also shown that there is a steady increase of the revenue derived from Baths and Wash-houses in London from the commencement of the undertaking in 1846—a statement which ought to satisfy every one of the practical utility of these institutions, and their effect in ameliorating the physical and social condition of the industrious classes—viz :—

	£	s.	d.
The aggregate receipts at nine establishments in the Metropolis, inclusive of the George-street establishment, during 1853 amount to	18,213	5	8
1852—Eight Establishments	15,629	5	8
1851—Six Establishments	12,906	12	5
1850—Four Establishments	9,823	10	6
1849—Three Establishments	6,379	17	2
1848—Two Establishments	2,896	5	1
1847) Ditto	3,222	1	5
1846)			
Showing an increase in 1853 over 1848 of	£15,317	0	7

"Another important fact is, that the receipts at the Wash-houses, above enumerated, during 1853, have been £4,153 6s. 3d. against £2,449 19s. 5d. in 1852; and the number of washers, 269,040 against 197,641; showing an increase of £1,703 6s. 10d. in money, and 71,399 washers. In 1851 the aggregate receipts at three Wash-houses then opened were only £609 19s. 4d., and the number of the washers, only 60,154.

"These figures prove that the Public Wash-house is steadily gaining favour among the working classes, and so regular is the increasing demand for accommodation, that it is anticipated by the Boards of Commissioners of several of the existing establishments that they will soon find it necessary to extend their washing and drying accommodation."

Notwithstanding this great array of figures, much remains to be accomplished yet, before the movement will have become commensurate in extent with the requirements of the community. A statistical investigation shews that in London, in 1852; the total numbers of baths supplied, reached to the proportion of only 1 bath to every 3 of the population; in Paris, where the accommodation of swimming baths in the Seine has long afforded much greater facilities for this wholesome process than existed in England, the number of baths reached the proportion of 2.23 baths to every inhabitant; or in other words, in London only 1 out of every 3 took one bath in the whole year, while in Paris every single individual bathed at least twice in the year. Yet the commissioners, reporting on the state of things in the latter city, observe, "you are ignorant, gentlemen, that there are many persons in Paris who have never known what it was to wash their shirt, and who never take it off till it falls from them, and can be no longer used." If this applied to Paris with its numerous baths, what shall we think of the state of the poor in London, or at home here in Dublin. We are told that in the Moorish city of Cordova there were 900 Public Baths. And this brings us to speak of the condition of things in this city, and the present position of this great movement amongst us; we lately took an opportunity of inspecting the baths and wash-houses established in connection with the Mendicity Association of Dublin. An apparatus has been erected consisting of 25 baths, viz., 5 extra first class, 4 first class for males, and 2 for females, 10 second class for males, and 2 for females, and 2 second class for the use of the poor of the institution. A wash-house has been established, furnished with 40 commodious wash stalls, and apparatus for drying and ironing clothes. The total cost of the erection of the baths and wash-houses amounted to £1,860. In many respects this establishment is well adapted to meet the wants of the poor. It is on the borders of a very thickly populated and poor district. We regret to learn, however, that the institution is not in a successful condition; it is but little availed of by the class of persons who most require it, and one department, that of the wash-house, has proved all but a complete failure. Much credit is due to the gentlemen who have given their time to the establishment and working of this institution, and we regret much to be obliged to censure the proceedings of a committee composed of gentlemen who sacrifice their business or leisure hours to the management of a humane institution and the furtherance of a charitable work. But when good things are to be done, they must be done well, energetically, and effectively, or they had better be let alone altogether. Now from what we

have seen and learned, we are compelled to say that there are several radical faults in the management of the bath and wash-house department of this institution, and that it is by no means worked with proper energy. There are likewise serious defects in some of the most important parts of the apparatus. The affairs of the association at large, including the baths and wash houses, are managed by a body of officers and a committee, comprising patron, president, 16 vice-presidents, and 56 committee-men, the whole embracing many of the chief dignitaries of the land. Such a committee, it is easy to see, is badly calculated for any kind of work. Yet such is the constitution of almost all committees of societies in this city; and it is against this system, not against any individual society, that our strictures are directed. We deeply regret that they should be called forth in the case of so good and humane an institution as the Mendicity Association. The great majority of our so-called managing committee consists of gentlemen of important social position, or high mercantile standing, and who, beyond the support, whatever it be, that may be derived from the influence of their names, cannot possibly be expected to engage actively in the working details of the institutions. They wish well to this and other good projects; they will give it their countenance and support in such ways as they can; and for a year or two will take the chairs and vice-chairs, and swell the fashionable throng of annual meetings; and with, for the moment, thoroughly hearty and sincere well-wishings, will join in mutual congratulations and conglorifications on "the highly satisfactory progress made within the last year," and will return each other thanks, and will laud and return thanks to honorary secretaries; while acknowledgments of "most disinterested support," and "very dignified conduct," will superabound. Meantime some cut and dry report, embodying for the hundredth time the same universal annual laudation and self-congratulation, will pass with acclamation, to be followed by the usual high-flowing newspaper account of the whole proceedings, which appears next morning, often coloured and exaggerated to the most gross and unwarrantable extent. And yet the business, the real practical matter, of which this glare, and glitter, and flash, and utter sham, make up the magnified image, may be sadly neglected, may be, in fact, in the worst possible condition; so far from progressing it may be retrograding, and this, be it understood, with the most perfect good faith on the part of all concerned. It is the system which we have grown up in, and breathed and lived in: an atmosphere of self-congratulation and of mutual, and what is more, of entire self-deception. And till we put an end to this, nothing will really and solidly succeed with us. We have in our eye at this instant more than one striking example of the truth of what we here state, and of the well proven and utter delusion of congratulating and self-landing reports. Indeed, we have known societies to be startled in the midst of their congratulations with the discovery of their bankruptcy; so that we have really at last come to regard the *congratulatory stage* of a society as one of almost fatal portent, and to look upon *conglorification* as only the next step to final dissolution. If these observations give offence we cannot help it; we are convinced of the existence and extent of the evils to which they apply, and we express our

opinions purely in the hope that they may encourage others to examine and speak for themselves. Be that as it may, however, the proprietors of this Journal are determined to expose and denounce everything that is sham and unreal, and to set up in its stead, when, and where, and how they best can, only what is most true, most real, and what will bear the closest scrutiny of friends or foes. It is therefore with these principles we are actuated in speaking with censure of the proceedings of the Committee of the Mendicity Association in reference to the bath and wash-house movement, and the many inconsiderate statements in their Report* relating thereto. We have seen that the institution comprises but 25 baths, of which only 12 are of the second class, 10 for males and 2 for females, besides 2 for the poor of the institution; there is no plunge bath. That the people would gladly avail themselves of the baths may be gathered from the figures of the Report: 28,056 baths were given from 21st May to 31st December. Taking 40,000 for the year, which would be a high average, this would give about 1 bath per annum to every 6 of the population of Dublin; it is needless to point out how miserably inadequate this number is to the wants of the city; yet we find such passages as the following in the Report:—"Your committee report that the additional baths referred to last year were completed in the summer, and there is now an establishment of baths and wash-houses more than adequate to the demands of the inhabitants of Dublin." This is the height of *congratulatory imbecility*. At page 8 it is stated that the income of the baths and wash-houses for the year has been calculated to amount to £405 18s. 3½d., and the expense to £360 13s. 8d., leaving a balance of £45 4s. 7½d. to the payment of interest on capital expended (£1,860); and yet, at page 10, we are informed, that "the results of the past year show that at present the baths and wash-houses are not self-supporting, and that there is no immediate necessity for any other public establishment of a similar description in the city." We wonder what the reporters would consider to constitute an "immediate necessity" for baths. We would recommend them to walk through the Liberties, and the North Lots, and the dens that lie between the College Park and the river and the sea, to improve their judgment on these matters. The next passage we shall cite implies such a mistaken view of the nature and objects of the establishment, that we are sure it needs only to be pointed out, to be indignantly repudiated by every member of the committee. "Your committee, however, hope, that from the increased charge of the second class warm baths, there will, hereafter, be a reasonable return on the capital vested in this establishment."

The wash-house department, with its 40 well erected and commodious stalls, is that which is in the most unsatisfactory condition. It is, at present, all but deserted; the number of persons who availed themselves of it during the past year, were only 508; while the stalls, if used but *once a day each*, would accommodate over 12,000 persons. We believe the great and radical defect here, is the utterly inefficient system of drying, which it now requires hours to accomplish, *each person being obliged to*

* Thirty-sixth Annual Report of the Dublin Mendicity Association for 1853.

pay one penny per hour while she is in the institution. The importance of rapidity of drying, as essential to the success of these institutions, was recognised from the very commencement. The French Commissioners thought the delay, which was not obviated at the time they reported, would be fatal. We have seen what time, labour, and talent, was expended by the London Committee to effect this object; and yet, here in Dublin, when a small outlay would procure proper and efficient apparatus, and when advice on the subject is to be had *gratis* from Mr. Baly, we allow such a valuable means of improving the condition of the industrious classes amongst us, to be all but dead in our hands. This is truly *shameful* apathy. Looking to the possibility of working this institution, in relation to its bath and wash-house department, on a larger and more energetic system, we would recommend that the example of the London Committee should be followed, and that a number of those most interested in the project, and possessed of practical business habits, should be declared "The Working Committee, for the management of the Public Baths and Wash-houses;" they may continue to be under the authority of, and responsible to the general committee, but that they should themselves have full executive powers. We believe that from six to ten such persons could be readily found, who would devote sufficient time and attention to the institution, to insure its practical success, and its extension amongst the poor. In London "The Committee for General Purposes" numbers but 17, though we doubt not that even titles could have been got by the hundred, for such a purpose. In advocating small committees, we are urging a principle which we would wish to see carried out in this city, in more instances than that now before us. Numbers dilute responsibility to an infinitesimal feeling. It is an old saying, "what is every body's business, is no body's," but it is only strictly true. To advance any project to success, requires only the co-operation of some few men, they may be from five to ten, certainly not more, of active and practical minds, thoroughly imbued with the value and importance of what they wish to accomplish, with a feeling of its necessity, and a belief in its possibility. With faith, and hope, and work, there is nothing that cannot be accomplished, and that soon and well. We wish well to the Committee of the Baths and Wash-houses of Dublin; few believe more strongly in the great importance of this movement, and we trust our remarks will be taken, as they are meant, in good faith, honestly, though hardly expressed, and in all good part, though in the guise of censure.

ART. II.—The Universal Exhibition of the Products of Industry and of Works of Art in Paris in 1855.

[We beg to call the attention of our Irish readers to Article 34, in which it is stated that the products exhibited by a city or a department may be exhibited separately, when it does not interfere with the general arrangement of the Exhibition. In virtue of this Article, all contributions from Ireland might be easily grouped together. Will some of the Local Committees who have undertaken the management of the Exhibition, see to this?]

GENERAL REGULATIONS.

(Continued from page 136.)

Art. 19.—The consignment of each exhibitor, whether sent with those of other exhibitors or separately, must be accompanied by a bulletin of admission delivered by the competent authority. This bulletin, drawn up in triplicate, and in the form prescribed by Art. 12, will likewise contain the number and weight of the several packages, as well as the particulars and price of every article composing the consignment. Models of these bulletins will be sent to all committees, French and foreign.

Art. 20.—The French objects intended for the Universal Exhibition will be forwarded from the places appointed for the purpose by the departmental and colonial committees, and taken back from Paris to the same places, at the expense of the State. Foreign articles, having the same destination, will likewise be conveyed to Paris at the cost of the State, but only from the French frontier, and will be sent back under the same conditions.

Art. 21.—They must be addressed to the commissioner of arrangement at the Exhibition Palace.

Art. 22.—The address of each package destined for the Exhibition, ought to bear, in clear and legible characters, the indication :

Of the place from which it comes,
Of the name of the exhibitor,
And of the nature of the contents.

MODEL OF ADDRESS.

A Monsieur le Commissaire du classement de l'Exposition universelle.

Au Palais de l'Exposition.—PARIS.

Envoi de (here come the name and christian names of the person sending, or the name of the firm), *demeurant à* (residence, or seat of the establishment), *exposant de* (nature of the object exhibited).

Art. 23.—Packages containing articles sent by several exhibitors, must have the names of all those exhibitors inscribed on the address, and be accompanied by a separate bulletin of admission for each of them.

Art. 24.—Exhibitors are requested not to send separately packages of less dimensions than half a cubic metre,* but to place in the same packing-case with other packages of the same class, such as come within these dimensions.

Art. 25.—The admission of all articles to the Exhibition will be gratuitous.

Art. 26.—Exhibitors will not be subjected to payments of any kind, either for entrance, or space, or on any other pretext whatever, during the whole time of the Exhibition.

* A cubic metre is equal to 35·3 cubic feet ; and a half, to 17·6 cubic feet.

Art. 27.—The Imperial Commission will provide for the moving, placing, and arranging of articles in the interior of the Exhibition-Palace: also for the works necessary to set the machinery in motion.

Art. 28.—Tables, counters, flooring, enclosures, barriers, and partitions between the various sections of products, will be furnished gratuitously.

Art. 29.—All particular arrangements, such as stands, shelves, supports, suspenders, glass-cases, hangings, awnings, paintings, and ornaments, will be at the charge of the exhibitor.

Art. 30.—These dispositions, arrangements, and ornamentations, can only be executed in conformity with the general plan, and under the superintendence of inspectors, who will determine the height and form of the front of the stalls, and likewise the colour of the painting, hangings, and draperies.

Art. 31.—Workmen, designated or approved of by the Imperial Commission, will hold themselves at the disposition of the exhibitors, and their bills will be examined by agents specially appointed for the purpose, should the exhibitors desire it. Nevertheless, exhibitors will be at liberty to employ such workmen as they may think fit, having previously obtained the authorization of the Commission.

Art. 32.—Manufacturers wishing to exhibit machinery or other objects of extraordinary weight or size, and which will require foundations or special constructions, must make a declaration to that effect, on their demand for space.

Art. 33.—Likewise, persons intending to exhibit machinery which is to be moved by steam, or fountains throwing up water, or hydraulic engines, ought to make a declaration of their intention at an early period, and state the quantity and degree of pressure of steam and water which they may require.

Art. 34.—The various products will be arranged together by nations, in the order of the classification indicated in Art. 16. Nevertheless, the different products exhibited by an individual, corporate body, city, department, or colony, may, if necessary, and with the authorization of the Executive Committee, be exhibited in separate groups when that disposition does not materially interfere with the regular arrangements.

Art. 35.—The Imperial Commission will take every measure to preserve from damage the articles exhibited. Nevertheless, if, notwithstanding these precautions, some accident should chance to occur, the Commission will not hold itself responsible for any damage which might result. These risks exhibitors must take on themselves, as likewise the expense of insurance, should they consider that precaution necessary.

Art. 36.—The Imperial Commission will likewise take care that the goods shall be watched over by an active and numerous staff; the Commission, will not, however, be responsible for any thefts or frauds which may take place.

Art. 37.—Each exhibitor will have the faculty of having his goods watched over at the Exhibition by an agent chosen by himself. Notice must be given, before the Exhibition opens, of the name and position of this agent. A personal card of admission will be given him, which, as long as the Exhibition remains open, he is neither to transfer or lend, under pain of forfeiture.

Art. 38.—The agents of exhibitors must confine themselves to answering such questions as may be addressed to them, and to delivering cards of address, prospectuses, or lists of prices, when asked for. They will be interdicted, under pain of expulsion, from soliciting the attention of visitors, or inducing them to purchase the articles exhibited.

Art. 39.—The current trade price of any article, at the period of the Exhibition, may be prominently affixed to it. Any exhibitor, who may wish to avail himself of this permission, must announce his intention beforehand to the local committee of his division, who will sanction the prices, on having ascertained their correctness. The price thus affixed must, in case of a sale taking place, be strictly adhered to by the exhibitor, as regards the buyer. In case the declaration should be proved to be false, the Imperial Commission may order the goods to be removed from the building, and the exhibitor excluded from exhibiting any longer.

Art. 40.—Articles sold cannot be removed until the close of the Exhibition.

FOREIGN GOODS.—CUSTOMS.

Art. 41.—With respect to foreign Goods admitted to the Exhibition, the Exhibition-Palace will be constituted a bonded warehouse.

Art. 42.—These goods, accompanied by the bulletins mentioned in Art. 19, will enter France by the ports and frontier-towns here mentioned, viz.:—Lisle, Valenciennes, Forbach, Wissemburg, Strasburg, Saint-Louis, Les-Verrières-de-Joux, Pont-de-Beauvoisin, Chapareillan, Saint-Laurent-du-Var, Marseilles, Cette, Port-Vendres, Perpignan, Bayonne, Bordeaux, Nantes, Havre, Bonlogne, Calais, and Dunkirk.

Art. 43.—Packages may be directed to agents designated by the Imperial Commission in each of these ports or towns. These agents, for a certain amount of remuneration fixed beforehand, will undertake the requisite custom-house formalities, and forward the articles to the Exhibition-Palace.

Art. 44.—Foreign goods, thus imported into France, will be received at the Exhibition-Palace, where they will be taken charge of by the custom-house officers.

Art. 45.—The removal of the lead-stamps, and the opening of the packages, can only take place in the interior of the Palace, in presence of the exhibitors or of their agents, and by the custom-house officers.

Art. 46.—One copy of the bulletin sent with each package, to be considered as certificate of origin, will be retained by the customs-department; another copy will be left with the commissioner of arrangement at the Exhibition; and the third will be deposited at the office of the Secretary of the Imperial Commission.

Art. 47.—Foreign exhibitors or their agents, will have to declare, after the close of the Exhibition, whether their goods are intended for re-exportation, or for interior consumption. In the latter case, they will be at liberty to dispose of them immediately, after paying the duty, in the fixing of which the Customs' authorities will take into account the depreciation the goods may have undergone in consequence of their stay in the Exhibition.

Art. 48.—Goods, at all other times prohibited, will, by special exception, be admitted to interior consumption, on paying a duty of 20 per cent. on their actual value. That amount of duty will be the maximum levied on any article exhibited.

INTERIOR ORGANISATION AND POLICE ARRANGEMENTS.

Art. 49.—The interior organisation and police of the Exhibition, are placed under the direction of an Executive Committee, composed of different heads of department, who will decide on all questions coming under their jurisdiction.

Art. 50.—A set of regulations, published before the time fixed for the reception of goods, and posted up within the building, will decide all points relative to the order of the interior service, and will designate the persons charged to assist the exhibitors, and to watch over the order and security of the Exhibition.

Art. 51.—The agents and officers attached to the foreign divisions, must speak one or more of the languages of those nations with which they are to be in communication. Interpreters, officially designated by the Imperial Commission, will, besides, be placed in various parts of the foreign division.

Art. 52.—Foreign Governments are requested to accredit to the Imperial Commission, special commissioners, whose duty it will be to represent their countrymen at the Exhibition, during the reception, classification, and placing of the goods, and in all circumstances where their interests are concerned.

PROTECTION OF INDUSTRIAL DESIGNS AND INVENTIONS.

Art. 53.—Every exhibitor who is the inventor or legal proprietor of any process, machine, or design, admitted to the Exhibition, and not yet registered or patented, may obtain from the Imperial Commission a certificate descriptive of the article exhibited, provided he make an application to that effect, before the opening of the exhibition, or during the first month after the opening.

Art. 54.—That certificate will secure to the person who receives it the property of the article therein described, as well as the exclusive privilege of employ-

ing it to the best advantage, for the period of one year, from the 1st of May, 1855, without prejudice to any patent which the exhibitor may take out, in the usual manner, before the expiration of that period.

Art. 55.—Every application for an inventor's certificate should be accompanied by an accurate description of the object or objects for which protection is sought, and, should it be necessary, by a plan or drawing of the said objects.

Art. 56.—These applications, as well as the decisions arrived at with regard to them, will be inscribed in a register kept for the purpose, and which will be ultimately deposited at the office of the Minister of Agriculture, Commerce, and Public Works, (department of industry,) to serve as a proof, during the period above indicated, of the validity of the certificates.

Art. 57.—These certificates will be delivered without any charge.

JURIES AND REWARDS.

Art. 58.—The examination of the articles exhibited, and the decisions with respect to the rewards to be given, will be confided to a great international mixed jury. This jury will be composed of members and deputies, who will be divided into thirty special juries, corresponding to the thirty classes mentioned in Art. 16.

Art. 59.—In the division of Products of Industry the number of members, for each special jury, is fixed as follows:

For each of the classes,

	Jurors.	Deputies.
3, 10, 20, and 23,	14	4
2, 6, 16, 18, and 24,	12	3
7, 8, 12, 13, 14, 17, 19, 21, 25, and 26,	10	2
1, 4, 5, 9, 11, 15, 22, and 27,	8	2
In the division of Works of Art,		
Class 28 will have,	20	
29 "	14	
30 "	8	

Art. 60.—The number of jurors to be appointed, will be for France as well as for each foreign country, in proportion to the number of exhibitors furnished by each.

Art. 61.—The official committee of each country will designate persons to form the number of jurors which that country is entitled to nominate. The French jurors for the first 27 classes will be nominated by the section of Agriculture and Industry of the Imperial Commission, and for the last 3 classes by the section of the Fine-Arts.

Art. 62.—In case the Committee of any country exhibiting should not appoint jurors to represent it, the omission will be met by means of the general meeting of the jurors present.

Art. 63.—The Imperial Commission will make the division of the members of the international jury amongst the various classes. It will also fix the general rules which will serve as the basis for the operations of the special juries.

Art. 64.—Each special jury will have a president named by the Imperial Commission; likewise, a vice-president and a reporter, both of whom will be nominated by an absolute majority of the votes of the jury.

Art. 65.—In case none of the members should obtain the absolute majority, the two candidates who have received the greatest number of votes will decide the point by lot.

Art. 66.—The president of each jury, and in his absence the vice-president, will, in case of equality of numbers, have the casting-vote.

Art. 67.—Special juries will, besides, be distributed into groups representing the branches of industry, connected together by certain points of analogy or similitude. These groups are eight in number, in conformity with the statement made in Art. 16. The members of each group will elect their own president and vice-president.

Art. 68.—The decisions of any special jury can only be definitive when sanctioned by the group to which it belongs.

Art. 69.—Rewards of the highest degree will not be granted until after they have been revised by a council, composed of the presidents and vice-presidents of the special juries. The jury for the Fine-Arts is excepted from this regulation.

Art. 70.—Each special jury will be at liberty to call to its assistance, as associates or experts, one or more persons, technically acquainted with any of the articles submitted to it for examination. These persons may be selected either from the members and deputies of the other classes, or from amongst persons who do not belong to the jury, but possess the required information. The members, thus called in, will only take part in the labours of the jury as regards the particular object for which their services were required: they will only be entitled to take part in the discussion, and not to vote.

Art. 71.—Such exhibitors as may accept the functions of jurors or deputies, will be by that fact rendered ineligible to receive any reward. The jury for the Fine-Arts is excepted from this regulation.

Art. 72.—Such exhibitors also as have been called in to aid juries, as associates or experts, will be held ineligible to receive a reward, but only for the particular class in which they have acted.

Art. 73.—Each jury may, according to circumstances, subdivide itself into committees; but it cannot come to any final decision without the sanction of the majority of the entire jury.

Art. 74.—Special commissioners, assisted by the inspectors of the Exhibition, will be charged to prepare the works for the jury; to see that the goods of no exhibitor escape their examination; to receive the observations and complaints of the exhibitors; to have all omissions, errors, or confusions repaired; to take care that the established rules are observed; and to explain these rules to the juries, when necessary.

Art. 75.—These commissioners will not interfere with the deliberations of the jury, further than to bring before them facts, remind them of rules, and present the complaints of exhibitors.

Art. 76.—The nature of the rewards to be distributed, and the general principles to be adopted as the basis of such rewards, will be at a later period determined by a decree based on the recommendations of the Imperial Commission.

Art. 77.—However, independently of the honorary distinctions which may be granted, the Council of presidents and vice-presidents, will have the power of recommending to the Emperor, such exhibitors as they may think deserving of special marks of public gratitude, on account of extraordinary services rendered to civilization, humanity, sciences, and the arts; or of encouragements of a different kind, for considerable sacrifices incurred with a view to general utility, due attention being always paid to the position of the inventors or producers.

SPECIAL ARRANGEMENTS FOR THE FINE-ARTS.

Art. 78.—A French jury, instituted at Paris, will decide on the admission of the works of French artists.

Art. 79.—The members of the French jury of admission will be nominated by the section of the Fine-Arts of the Imperial Commission.

Art. 80.—The jury of admission for the Fine-Arts will be divided into three sections. The first will comprise painting, engraving, and lithographic works. The second, sculpture and die-sinking. The third, architecture. Each of these sections will decide with respect to works belonging to its special department.

Art. 81.—The Exhibition is open to the works of all French and foreign artists alive on the 22nd of June, 1853, the date of the decree which constitutes the Exhibition of the Fine-Arts.

Art. 82.—Artists can present to the Universal Exhibition, works which have been previously exhibited; but there cannot be admitted—1, copies (excepting such as may reproduce a work in a different manner, on enamel, by drawing, etc.); 2, pictures and other objects without frames; 3, sculptures in unbaked clay.

Art. 83.—The following articles of the present regulations are applicable to the division of the Fine-Arts:—Arts 1 to 13; 15 to 30; 35, 36, 40 to 47; 49 to 52; and 53 to 77.

FUNCTIONS OF LOCAL COMMITTEES.—INSTRUCTIONS.

The local committees are the official and necessary medium of communication between the Imperial Commission and all the persons who intend taking part in the Universal Exhibition of 1855.

They will be in direct communication with the Imperial Commission, and will correspond with it, through their presidents and secretaries, for all the information which they may stand in need of in the interest of their mission.

The Imperial Commission will transmit to them, according as circumstances may require, the documents, instructions, and suggestions calculated to enlighten them on all the questions relative to the Exhibition.

The Imperial Commission, in thus enabling the local committees to supply its place and to act directly under their own inspirations, considers itself obliged to decline all intercourse and all direct correspondence with the persons or industrial firms which intend taking part in the exhibition; it cannot and will not correspond but with the committees.

The mission of the local committees is:

1st, To execute and cause to be executed, as far as they are concerned, the provisions of the general regulations.

2ndly, To disseminate within the circle of their locality all the information and suggestions likely to strongly direct the attention of the parties interested to the object of the Exhibition.

3rdly, To open a register, in which all persons who desire to take part in the Exhibition will be bound to get their names inscribed, on applying for it either verbally or in writing. In this register will be specified the nature of the objects which each person inscribed proposes to send, and the space which is required for their being arranged in place.*

4thly, To give, within the shortest possible period, to the Imperial Commission an idea of the probable number of exhibitors from their localities, and of the space which their articles may occupy.

5thly, To encourage, by every means in their power, the fabrication of objects calculated to throw lustre on our manufactures.

6thly, To visit, for that purpose, all the manufactories and places of production in their neighbourhood, and to enter into direct communication with the proprietors.

7thly, To fulfil, when the proper time arrives, the functions of a jury, and to decide on the rejection and admission of the articles proposed.†

8thly, To forward to the Imperial Commission, after their examination, a list of the exhibitors admitted.

9thly, To have the objects which they will have decided to admit, and which will be sent to the Exhibition, accompanied by the necessary papers and documents.

10thly, To point out, in a written report, the services rendered to agriculture and manufactures by the proprietors of works and factories, foremen, workmen, or labourers, residing in their neighbourhood.

11thly, To stimulate around them the desire to visit the Exhibition, and to facilitate the means of doing so as much as lies in their power.

12thly, To make known to the Imperial Commission the measures which may appear to them calculated to procure for the greatest possible number of workmen from their neighbourhood the means of visiting the Exhibition.

* The manufacturers ought to limit the number of articles which they intend exhibiting to the proportion strictly necessary to allow their establishments to be sufficiently appreciated. Art. 13 of the general regulations specifies the objects which are not admissible to the Universal Exhibition.

† The Imperial Commission, being unwilling to use, except in cases of absolute necessity, the right which it has reserved to itself of admitting or rejecting, without appeal, the articles presented, recommends the committees from the very outset to encourage only the production of such articles as may contribute to the better knowledge of their local manufactures and to their celebrity

JOURNAL OF SOCIAL PROGRESS.

ART. I.—*Proposal to establish an additional Bank in Dublin considered.* By "TURGOT."

It is currently reported in commercial circles that one of the Northern banks has it in contemplation to open a branch in Dublin, provided the general trade of the country continues as prosperous throughout the ensuing year as it has been during the past. To such an event many of our traders look forward with considerable anxiety and hope. Their knowledge that the system of business pursued by the Northern banks approximates closely to that which has been termed the "Scotch system," and their conviction, that wherever the latter has been introduced prosperity has almost invariably followed, have naturally led them to anticipate the most beneficial results from the opening of such an establishment here. As it is quite possible, however, that when once established, such a bank might practically confine its operations within the limits which custom has hitherto prescribed amongst us, it would be advisable that our merchants should not be overhasty in giving to this project the sanction of their support, until they have obtained some guarantee that their expectations are likely to be realized.

It is certainly an unquestionable fact that the system of banking hitherto exclusively pursued in Dublin is defective in some essential particulars. In the first place, it is virtually a mere discount system, and a discount system, however perfect in itself, cannot possibly suffice for the wants of any town which possesses manufactures of its own, and which desires that those manufactures should attain to their highest possible development.* If Dublin were a mere emporium for the reception and distribution of English goods, and if her citizens consisted exclusively of merchants and extensive traders, the discount of their bills would, undoubtedly, be the most essential accommodation which they would require; but as this is not the case, as we have manufacturers as well as traders to provide for, it is evident that cash credits are just as requisite as the discount of bills, and that their total absence from the operations of our various banks must have hitherto exerted a most unfortunate influence in depressing, if not entirely extinguishing, every species of manufacturing enterprise.

* It may perhaps be as well to remind the reader of the following facts:—1st, That as the merchant and trader have not generally any very heavy outlay in the form of wages, the credit in goods which they receive from the manufacturers and wholesale firms with which they deal, is, in ordinary cases, sufficient for their wants. 2nd, That owing to the large expenditure in the purchase of machinery and the

Nor is this all. A second and scarcely less important objection to which this system of discounts is liable is, that it can hardly be said to provide an accommodation of any kind to a very numerous portion of our traders, viz., those whose business is comparatively small, and whose sales are either for ready money or on too limited a scale to require a settlement by bill. It is true that the banks do not actively discountenance these small "operative deposit accounts," but as they will not permit them to be temporarily overdrawn to meet any sudden requirements, and as they are not in the practice of allowing interest upon any but permanent deposits, say of three months' duration, it is clear that the small trader has no inducement whatever to lodge the proceeds of his sales from day to day, as his money, although unemployed, will be equally remunerative, or else more readily available in his own possession. In this respect his position is still more unfortunate than that of the manufacturer. The latter can have his bills discounted, which is *some* accommodation, although not to the extent which he peculiarly requires, the former has no bills to discount, and receives, therefore, no accommodation of any kind. And hence he is deprived of that constant stimulus to thrift and prudence which has operated so beneficially upon the character of the citizens in many of the Scotch and English towns.

But there is another objection to which, even as a discount system, our Dublin mode of banking is liable, and the evil in this case is one that falls equally on both classes of our citizens, the merchant as well as the manufacturer. The discount system may be regarded as perfect when each bank transacts all the legitimate business of each of its customers, so that they may not be obliged to keep an account at the same time with any similar establishment. Now there is no single bank in Dublin which carries out this principle. Up to the present time they have each been satisfied to supply only a portion of the requirements of their customers, generally a very indefinite portion, leaving the remainder to be provided for by any other bank with which they may choose to deal. Now, the consequences of this system have been extremely injurious to both parties. To the banks themselves it has probably been the most detrimental, as in sacrificing a large proportion of the merchant's business they have necessarily at the same time sacrificed that insight into his position, which, on a judicious system, should always form the basis of their operations. To the merchant, however, it has been scarcely less disastrous. When he presents a docket of bills for discount he can never feel certain as to what proportion of them will be passed to his credit, and how many will be declined, and this uncertainty not only destroys his confidence in his banker, but often compels him at periods of unusual pressure, or when a

payment of wages to which the manufacturer is subject, a credit in cash is just as requisite to his operations as a credit in goods. 3rd, That the only available source to which the manufacturer can apply for a credit in cash is the bank by which his discounts are transacted. And 4th, That in all the manufacturing districts of England and Scotland, as well as in Belfast, it is the general practice of the banks to make liberal advances upon applications of this description. See *Impediments to the Manufacturing Prosperity of Dublin considered*; by the writer.

tightness pervades the money market, to make his docket as large as possible, by drawing upon customers from whom he might otherwise expect a settlement in cash within a very limited period.

I must not, however, be understood to imply that taken collectively our banks as a general rule do not discount all the legitimate trade bills that are tendered to them for that purpose. On the contrary, I fully believe that as far as the entire *volume* of their discounts is concerned, it has been amply sufficient for the trade that has existed in the city. Not that I mean to say that every bill drawn in Dublin is actually presented at one of the banks and discounted. There always are, in every large town, a considerable number of traders possessing a comparatively large amount of capital, or engaged in a peculiarly profitable line of business, who require an acceptance from their customers rather as a guarantee for punctual payment than from any want of ready money, and who either allow it to mature in their own hands or merely place it in the bank *pro forma* for collection. For such as these of course the banks have not to provide. But what I mean to say is, that of all the legitimate bills which are actually presented for discount, I believe the per-centage is but trifling of those which are not eventually converted into cash by some one or other of the banks. This is very far, however, from neutralizing the evil to the merchant, for although when he draws upon his customer he can feel tolerably confident that at some period or other before its maturing he will succeed in obtaining the discount of his bill, yet he can have no certainty that it will be at the time when he may especially require the proceeds; or indeed that it may not first be rejected by one, two, or even three of the banks in succession. And accordingly the practical consequence is, that many of our merchants feel obliged in self-protection to enlarge their docket by one-third, or sometimes by one-half more bills than the amount which would be requisite if they could only rely upon the bank's negotiating all of them. And this, as I have said, can only be effected by their drawing upon customers at unseasonable times or from whom a settlement in cash would be far more preferable.

If the preceding observations be correct, it will not be difficult to determine the precise character of the additional banking accommodation which is still required in Dublin. The first and most essential is the general adoption of the cash credit system, not by one or two of our banks merely, but by all of them, without exception. There is not, I presume, a single bank in Dublin which does not include a considerable number of manufacturers amongst its supporters, and for their sakes, if for nothing else, this system ought to be adopted. The fact is, however, that the interests of our traders would likewise be just as certainly promoted by it, though in a somewhat inferior degree. There are very few of our merchants or traders (no matter how wealthy) who will not, at times, be inconvenienced by the simultaneous falling due of a number of heavy bills, and who would not at such times feel the permission to overdraw a very important accommodation. But if our merchants would derive less benefit than our manufacturers from the introduction of cash credits, there can be no doubt that both classes would be alike benefited if each bank were to make a

fundamental rule of providing for the whole requirements of its supporters. This, accordingly, is our second great desideratum. As the former is essential to our highest manufacturing activity, so is the present to our general industrial and commercial prosperity. Like cash credits, however, it must be universal. There can be no sound banking operations which are not based upon a feeling of mutual confidence between the bank and its clients, and this confidence cannot possibly exist where the bank transacts only a portion of its customer's business, and has no means of knowing either the nature or the extent of the remaining part. And a third requirement is, that either some one or two of our existing banks should open accounts with our small dealers, and allow them interest on the daily balances to their credit upon current account, (which I believe is done by every bank in Scotland,) or else that another bank should be established for this special purpose. There is no reason that this latter change, like the two preceding, should be adopted universally. To our small retail shopkeepers it would be extremely advantageous, although less, perhaps, as a direct source of profit than as an incentive to general economy, but the increased business resulting from it might easily be transacted either by a single bank devoted to small accounts exclusively, or by one or two of our present establishments, in addition to their existing operations.

We are now in a position to determine the probable amount of benefit which would accrue to our traders and manufacturers from the introduction of a branch of one of the Northern banks into the metropolis. So far as cash credits are concerned, it will be evident upon a moment's reflection, that the greatest amount of business which, under the most favourable circumstances, it would be likely to transact for many years to come, could not possibly exercise any sensible influence upon the interests of our citizens generally. There is no other establishment, perhaps, to which the public are so slow and cautious in entrusting their confidence as to one of this class; a considerable period, therefore, must necessarily elapse before it would number any important section of our business men amongst its supporters; of these again it would probably be the smaller proportion who would require accounts of this sort, and as the advances to the latter could not exceed a moderate per-centage upon the year's transactions, the additional stimulus which it would impart to manufactures would be extremely limited, too limited in fact either to operate upon the labour market or to effect any change in the existing relations of demand and supply. The same observation holds equally good with regard to its transacting all the business of its clients, for so long as the latter comprised no more than a fraction of our citizens, the result upon trade in general would be scarcely, if at all, appreciable. On the other hand, if it were to confine its operations exclusively to "small accounts" with the class of dealers who do not at present economize their daily receipts by lodging them in the hands of any banker, there is no doubt that every single account so opened would be an additional accommodation, and that the amount of public benefit that would accrue from it would be exactly proportionate to the extent of the business transacted.

The preceding is an estimate of the *maximum* amount of benefit that

might result from the opening of a new bank in Dublin. There is, however, a *minimum* which must also be taken into consideration. It is possible that such an establishment might devote itself to one or other of the three courses of which I have spoken: the granting of cash credits, the transacting all the business of its clients, or the opening of small accounts, and allowing of interest upon operative deposit accounts; but it is equally possible that it might eschew all of these, and might exclusively confine itself to the system of discounts. Now, as I have already stated, the entire volume of discounts transacted by our existing banks is, undoubtedly, as great as the present trade of the city requires. But if so, it follows that the successful establishment of a new bank that would confine itself to this particular system would inevitably lead to the wholesale manufacture of accommodation bills—an evil which would ultimately prove as detrimental to the trade and credit of the city as any other that could readily be imagined. So that while by the adoption of the former course the new bank would, undoubtedly, be productive of considerable benefit, there is as little doubt that by following out the latter it would as inevitably produce a far more serious amount of injury.

The practical question for consideration, therefore, is, which of these courses is it most probable that the proposed bank would follow? or, to state the question differently,—whether is it more probable that it would pursue the system of its parent branch, merely introducing such modifications as the peculiar wants of our city might suggest, or that it would follow out the beaten track of Dublin banking? At first sight the former might seem the more probable—but only at first sight—for analogy irresistibly compels us to the opposite conclusion. It is well known, that those of our existing banks which have branches in the Northern province adopt the Northern system in Belfast and other towns, that is, systematically grant cash credits to those of their supporters who may require them; while in Dublin they follow just the opposite course, and may almost be said as systematically to refuse them. The fact is, that the character and system of such a branch depends far more upon the constitution of the local board of directors, than upon the character of the parent bank. If the directors are selected from a purely commercial class, they will scarcely be able to comprehend the wants of our manufacturers, and if they are men of narrow limited views, it can hardly be expected they will make any considerable sacrifice of thought or trouble, in order to ameliorate whatever system happens to be in existence. The probability is, that they will be selected altogether or principally from the same class as our present boards of directors, and as the latter have been satisfied with a system which provides only a partial accommodation even for our merchants and traders, and a very inadequate one for our manufacturers, we have no reason whatever to expect that another board of directors, selected from the same classes, would be guided by an essentially different principle throughout their operations. There does not appear to be any means, therefore, of evading the conclusion, that the proposed bank, if once established, will, in all probability, confine itself principally, if not exclusively, to the mere discount system; and if so, I have no hesitation in repeating, that any

benefit which it may produce will be far more than counterbalanced by the increased number of accommodation bills which it cannot fail to call into existence.

I need hardly add any thing more in order to show that under present circumstances our merchants and traders ought to abstain from giving any decided encouragement to an undertaking, the advantages of which depend upon contingencies so doubtful. It is true that the proposed bank *might* be conducted upon principles which would render it an important public convenience; but it is certainly far more probable, that if it did not altogether fail in obtaining efficient support it would become a dangerous incentive to the prosecution of an illegitimate trade. And that being the case, the course which prudence would dictate cannot be uncertain. It will not be necessary, however, that our merchants should abstain from all action in connexion with this question, for there still remain several courses which might be pursued with perfect safety, and which could hardly fail to promote the object which they have in view. One of these appears to me to be so important, that I trust to be excused if I offer a few remarks upon it.

I have already shown, that what we now especially require in Dublin is, that the banks generally should adopt the two-fold system of transacting the whole business of each of their customers, and of granting cash credits in suitable proportions to such as may require them. The latter would be peculiarly advantageous to our manufacturers, the former is alike requisite to all who keep banking accounts indiscriminately. It is not to be supposed, however, that our banks will simultaneously and instantaneously introduce an important change of this character. It is rather to be expected that they will adopt it gradually and cautiously; that they will commence with small experiments, and that it will not be till those experiments have resulted satisfactorily that they will increase them to any important extent. Or rather, the probability is, that our banks generally will not take any steps to modify their existing system until the example has been set them by the Bank of Ireland. On the other hand, when once the latter has taken the initiative, there can be little doubt but that its example will shortly be followed universally. It is to the Bank of Ireland, therefore, that we must look for the first decisive movement in favour of the proposed changes.

We are not to expect, however, that either the Bank of Ireland, or any other bank, will deliberately alter its system of management for the benefit of our citizens, until it is solicited to do so by those citizens themselves. It is no more possible for a bank than for any other establishment or company to arrive at a knowledge of the wants of its customers by a process of intuition. Its directors are selected by ballot out of the body of its shareholders, and accordingly represent the wishes of those shareholders, not the wants of the public generally. An acquaintance with the latter must be arrived at by a different process. It is only from the manufacturers themselves that our bank directors can obtain anything like an adequate knowledge of their requirements. And the same is true of our merchants and traders. Whoever desires, either to understand the peculiar nature of their wants, or to

make the suitable provision for them, must derive the necessary information from themselves—there is no other possible method by which this object can be effected.

We are not to feel surprise, therefore, that our banks have not hitherto provided sufficient accommodation for the wants of our citizens. Up to the present moment, neither our merchants nor our manufacturers have ever, that I am aware of, made any collective effort to explain their wants to our bank directors. I have no doubt that many of them severally have, at times of pressure, urged the necessity of their individual requirements, but this has not been sufficient, nor ought our bank directors to be severely blamed if they have paid but little attention to such appeals, as it is not for exceptional wants that a bank can be expected to provide, but only for those which are common to a whole class of its supporters. Be that as it may, however, I think if blame is to attach anywhere, a considerable portion of it must be borne by our merchants and manufacturers themselves. Not only have they hitherto neglected to bring the subject formally before the notice of the banks, but, what is more surprising, they have not even subjected it to any searching discussion through the public press. While fully aware of the existing defects in our system of banking, and while not unfrequently suffering much inconvenience from those defects, they have made no strenuous effort of any kind to have them remedied, and have thereby appeared in some measure to acquiesce in their necessity.

I have said that it is the Bank of Ireland to which application ought to be made in the first instance for the introduction of the proposed modifications. And the course which I should respectfully urge upon our merchants and manufacturers, and which I think their own private interests and those of the public generally unite in recommending, would be, that they proceed at once to take the necessary steps for having the subject brought officially before the Directors of the Bank of Ireland. A number of the most eminent might hold a private meeting, and consult as to the most effectual mode in which this may be accomplished. They might appoint two or three of their number to prepare a statement of the general principles upon which they consider the proposed changes to be expedient, which statement might be received and approved of at a second meeting, which could be held for that especial purpose. They might then depute a few of their more influential members to present this statement to the Board of Directors, and to sustain it, if necessary, by such illustrations from their own experience as would suffice to show that they were not reasoning from exceptional cases, but from well recognised wants, that are common to the whole mass of the trading portion of our citizens. And if the deputation were judiciously selected from the various sections of commerce and manufacture, I think it is more than probable that the Governor and Directors would give every consideration to their suggestions, and would, before long, take measures for their safe and gradual adoption.

Nor would it be difficult to comprise a lucid statement of the case within very narrow limits. With regard to the expediency of each bank's transacting all the business of its customers, the advantages that would result

from this practice, both to the banks themselves and to their customers, are so evident that they would stand in need of very little elucidation. The importance and necessity of cash credits would require a somewhat ampler detail. In the first place it would have to be shown, that there are very few merchants or traders, no matter how wealthy, against whom some heavy bills may not occasionally fall due at inconvenient times, and who would not at such periods derive the greatest benefit from a moderate overdraw. And secondly, that owing to the continuous heavy outlay in the form of wages to which manufacturers are subject, and which must be expended before the raw material can be rendered saleable, the permission of a limited overdraw ought to be considered as essential a part of their requirements as the discount of their bills. And thirdly, that the adoption of the cash credit principle would be as advantageous to the banks themselves as to our merchants and manufacturers, as it would provide a profitable investment for funds that now lie unimproved, and which the present trade of the country is not sufficient to employ in discounts. And lastly, that the system has now been tried in all the manufacturing districts of England and Scotland, as well as in Belfast and Ulster generally, and has invariably resulted in the rapid development of local industry, and corresponding improvement in the condition of the population.

There is one point, however, which ought to be advanced with far more urgency than any of the others. It is not to be anticipated that the Bank of Ireland—no matter how cogent may be the arguments advanced—will at once proceed to grant cash credits to all, or even any, of its supporters who may desire them: such a course indeed would not be prudent, as no important alteration should ever be made in the system of management except upon the most mature deliberation. But I think it might reasonably be expected that the Board of Directors should at once recognise the principle involved in such a claim. I cannot see any reason why they should not acknowledge that a merchant or manufacturer may be perfectly solvent, and yet apply for an advance of this description; or that such an application is in every way as legitimate and as consistent with the soundest principles of business and banking as an application for the discount of his bills. Up to the present moment this principle has never been admitted by our Dublin banks, although it has long been, not only recognised, but acted upon in almost every other trading town in the empire. Until it has been adopted here, however, there can be but little prospect of any considerable development of our metropolitan resources. On the other hand, its formal recognition by the Bank of Ireland will be undoubtedly the first essential step towards its practical adoption generally. Let the Court of Directors once officially admit that cash credits are just as legitimate as the discount of bills, and that every bank should endeavour to transact all the business of its customers; let them only give these two principles the sanction of their approbation, and I feel no doubt that all the rest will follow in due course. At the same time, I do not think there is much probability of their speedily doing this, unless they are strongly incited to it by an influential body of our merchants and manufacturers. Upon the course pursued by the latter, therefore, the question

must now be considered essentially to depend; to their hands it must be committed; and I entertain a firm confidence, that they will not neglect so favourable an occasion for endeavouring to promote the trading interests of the city, when it is all but certain that their efforts will be crowned with the most complete success.

Sept. 30.—Since the preceding has been put into type, I have been informed that the Directors of the Bank of Ireland have made arrangements for an experiment to test the practicability of a partial adoption of the cash credit system in Dublin. If this be correct, I think there is little ground for doubt that the result will be so satisfactory as to lead to a gradual extension of such accounts, until they form an essential feature of the general operations of the Bank. It is to be hoped, however, that the Directors will not rest satisfied with this, but will avail themselves of an occasion so favourable for also making a similar experiment as to the feasibility of transacting all the discount business of their clients. The two courses are so mutually dependent, that the one experiment could not possibly command an adequate degree of success without the other. But in any case it must be acknowledged, that the Directors deserve great credit for having resolved on taking the initiative in so important a movement, and it may reasonably be anticipated that the other banks will not be slow in following their example.—“TURGOT.”

ART. II.—NOTICES OF BOOKS. *Lectures on Architecture and Painting, delivered at Edinburgh, in November, 1853. By JOHN RUSKIN, Author of “Modern Painters,” &c., [with Illustrations drawn by the Author.]* London: Smith, Elder, & Co., Cornhill, 1854.

MR. RUSKIN’S “Lectures on Architecture and Painting” cannot fail to interest every reader, even those by whom these subjects are but little considered. He seems to have composed and delivered these lectures with two objects: one, the hope of inducing the people of Edinburgh to make some use of the great natural advantages of their city, and so to give themselves some right to feel proud of it; and the other, the principal one, to express strongly to the general public some of the lecturer’s matured opinions on the generally practised styles of modern art. It will not, we hope, be quite useless to say a few words of this book, in which there is much that is true and that deserves to be widely read, though also some that seems to us to be founded on a somewhat one-sided and incorrect manner of considering the subject.

The first part of the volume is on Architecture, and the last is on Turner and Pre-Raffaellism, but the same class of general ideas are to be found in both parts. Mr. Ruskin's desire appears to be, to use his own words, "to annihilate the whole system of Greek architecture, as practised in the present day, because truth and judgment are its declared opposites." This may be true, applied to "Greek Architecture as practised in the present day," but Mr. Ruskin does not confine his objection to the modern (so called) Greek works; he more than hints that the whole system of ancient Greek Art is naturally bad and uninteresting, an opinion or theory into which we shall not on the present occasion follow him. He seems to believe that Gothic Art, *and no other*, will satisfy all the requirements of beauty, and strength, and variety, and that by our adoption of it *in every case*, we shall obtain a very great development of social as well as artistic improvements. The principal, indeed almost the only, reason given in support of this assertion is, that the Gothic style in architecture, according to Mr. Ruskin, adheres closely to nature in all its intentions, and does not copy any settled plan; and so, he says, it *must* be best, as in Nature only can Truth be found. And he applies the same reasoning to prove that the "Turneresque" and Pre-Raffaellite styles in Painting are alone good and useful, as they alone also copy Nature and Truth. In fact Mr Ruskin makes it quite a religious question, whether we shall not turn back to Gothic architecture and mediæval art, rather than go on plunging deeper and deeper into what he calls stupidity, falsehood, and profanity. Whether his love of the Gothic does not carry him much too far in his objection to the Greek architecture, we have said we shall not now discuss, but we believe it to be true that in the greater fitness of its steep gables and pointed spires for the northern climates, its greater room for decoration on account of so many parts *requiring* ornament, and its infinite variety, it must always be preferred by most people to the certainly very beautiful, but (in these darker latitudes) rather monotonous flat surfaces continually presented by the Greek buildings. "Ornament is the principal part of architecture," says Mr. Ruskin. We should rather say, "ornament is as necessary to perfect architecture as perfection of form," because no beauty of decoration can ever atone for want of symmetry of form. On the subject of ornament, however, the lecturer gives much valuable advice, which, with his reasons for it, seems to us the best part of the book, and so we shall ask our readers to consider it well, each in his own fashion.

The close adherence to Nature, which Mr. Ruskin finds, somewhat fantastically often, in Gothic architecture, requires, in ornamentation at least, that nature should be copied *directly*, so as to catch her spirit, and not at secondhand; and so he devotes a great part of his lectures to endeavouring to impress on his readers and on all mankind, if possible, the immense advantages of this principle of seeking always to find truth and beauty in the gloriously beautiful world round us. We entirely agree with Mr. Ruskin in this. There can never be forms more graceful and lovely than those which God has scattered everywhere, to be the endless sources of our delight; and to copy God's works is surely better for us than to try to imitate "conventional" figures of the same things. Who has ever

doubted, for a moment, the exact fitness of every arrangement of Nature? Who has not often wondered at the combination of delicate beauty with strength and power, in each of the very commonest natural objects around us? And surely few who have admired for one moment the perfection of God's work, can help giving another moment to thoughts of adoration and love of God. For this reason we heartily join in Mr. Ruskin's entreaty to his readers, to recollect the difference, in a moral point of view, that it must make to the workman to be asked to examine carefully, so as to copy as well as he can, any piece of nature, a delicate flower, or graceful wreath of ivy, or living animal, or human figure; instead of setting something before him, the original of which was perhaps at first, indeed, copied from life, but which has gone through so many stages of copy and imitation, that now it has lost its very name as well as its meaning. Monotonous work of any kind, even when well paid and performed under comfortable circumstances, is fatiguing and often complained of, but if to constant repetition you add perfect unmeaningness, (and generally ugliness,) it is strange, indeed, if the poor tired workman does not become disgusted with such a life; and many a one knows the misery of such a feeling. There must be *some* brains to be used, *some* taste to be properly directed, and *some* idea of grace and beauty, and power to express it, if they were but put into the right way and allowed to try it, among the working masons and carvers, the stucco workers and stonecutters, who now go on from day to day so wearily, with no other object given or permitted them, but that of copying some set form, and making it smooth, and *exactly like the last*. In Ireland, at least, this is surely true, and it is not too much to expect that a little interest in a man's work and some freedom in expressing *himself* through it, would, after Religion, do more to cheer his life, and to exalt and save his soul, than anything else that could be done for him. He would receive a new and better life, and the rich, who, unfortunately, seldom thoroughly understand the trials and wants of the poor, beyond those which are visible, and can be relieved by money, would, undoubtedly, have fewer complaints to make of reckless carelessness and unpunctuality.

"There is assuredly," says Mr. Ruskin, (p. 85,) "no action of our social life, however unimportant, which, by kindly thought, may not be made to have a beneficial influence upon others; and it is impossible to spend the smallest sum of money, for any not absolutely necessary purpose, without a grave responsibility attaching to the manner of spending it. The object we ourselves covet, may, indeed, be desirable and harmless, so far as we are concerned, but the providing us with it may, perhaps, be a very prejudicial occupation to some one else. And then it becomes instantly a moral question, whether we are to indulge ourselves or not. Whatever we wish to buy, we ought first to consider not only if the thing be fit for us, but if the manufacture of it be a wholesome and happy one; and if, on the whole, the sum we are going to spend will do as much good in this way as it would if spent in any other way. It may be said that we have not time to consider all this before we make a purchase. But no time could be spent in a more important duty; and God never imposes a duty without giving time to do it. Let us however only acknowledge the principle:—once make up your mind to allow the consideration of the *effect* of your purchases to regulate the *kind* of your purchase, and you will soon easily find grounds enough to decide upon. The plea of ignorance will never take away our responsibilities. It is written, 'If thou sayest, behold we knew it not; doth not he that pondereth thy heart consider it? and he that

keepeth thy soul, doth he not know it?' Now let us remember that every farthing we spend on objects of art has influence over men's minds and spirits, far more than over their bodies. By the purchase of every print which hangs on your walls, of every cup out of which you drink, and every table off which you eat your bread, you are educating a mass of men in one way or another. You are either employing them healthily or unwholesomely; you are making them lead happy or unhappy lives; you are leading them to look at Nature and to love her—to think, to feel, to enjoy,—or you are blinding them to Nature, and keeping them bound, like beasts of burden, in mechanical and monotonous employments. *We shall all be asked one day, why we did not think more of this.*"

In the lectures on Painting the same principle of attending only to Truth is carried out to yet a greater length, if possible, than in the first two, (on architecture,) and modernism is denounced as the deepest falsehood and profanity. Those are hard words, but there is no contradicting them. Religion and truth are *not* the first ideas with these generations; outward show, conventionality, and fashion, are the ruling considerations in everything that is attempted, from the building and decorating a cathedral church, down to the least arrangement of mere dress; and how to make a great show by means of shams of all kinds, is one of the most admired qualities in a workman. Therefore Mr. Ruskin may well call Modern Art profane, when comparing it with that Art which principally sprang from, or at least was nourished by that noble feeling which taught men to work for God, and as if directly in his presence, and to think nothing too great or good to offer him; that feeling which alone will set aside vanity, and trick, and meanness, and which will generally give even the coarsest materials and rudest forms an expression that will be looked for in vain in the most splendid works of these times. The Pre-Raphaelites, to whose defence one lecture is directed, whose avowed principle it is never, for the sake of any grace or beauty to be obtained, or for any reason whatsoever, to set *aside* or postpone the truth, have so far unquestionably taken a step in the right direction. It is by such resolution alone that they can ever conquer the evil principle that has brought us to the present state of falsehood. We must say, however, that Mr. Ruskin's enthusiasm leads him rather too far, if he really expects *them* to bring back the glories of the mediæval times; for sure it is that a love of truth *alone* will not do, however pure it may be; and that to be great artists men must be also; not only abler by far, but better, and purer, and nearer to God than a *mere* love of truth and nature can make them,—though while this lasts, it will doubtless preserve them from becoming absolutely degraded, as the trade artists of the present fashionable world will inevitably remain, and must have become, under the influence of such principles as trade artists believe and work on.

The third lecture, with its account of Turner and his predecessors in landscape painting, is particularly valuable: Mr. Ruskin's warm admiration and respect for that hitherto much misunderstood artist making his short account of his personal character very interesting, while it is also very different from that generally given. In this, as in many other parts of the volume, the evidence of perfect faith in what the writer says (one of the most refreshing things to the reader to find) is one of the peculiar

merits of the book. Unfortunately, however, this is, in many parts of these lectures, accompanied by so great an amount of intolerance for all other opinions than his own, that it seems to blind him to every beauty that is not to be found in mediæval art. To speak of ancient Grecian art as false and unnatural, and again, (for he is for ever bringing in his Protestantism *à propos* of every subject,) of the Catholic Church as "accursed" in its influence on Art, and even hesitate to pronounce it to be Christian at all: all this shows an extravagance so absurd, as to become nearly allied to madness, and takes away much from the usefulness of these lectures, as well as from the pleasure which every cultivated mind will be sure to enjoy in their perusal.

NOTE to the article "On the Establishment of a National Gallery in Ireland," *ante*, pp. 1 and 110—[JOURNAL OF SOCIAL PROGRESS for January and July, Nos. I. and VII.]

SINCE the above article was published, the exertions of the Committee of the Irish Institution for this object, have borne fruit in an Act of Parliament, one of the last passed in the session just concluded: "*An Act to provide for the establishment of a National Gallery of Paintings, Sculpture, and the Fine Arts, for the care of a Public Library, and the erection of a Public Museum in Dublin*," [17 & 18 Vict., cap. xcix. 10th August, 1854.] By this piece of legislation, not only is the establishment of a National Gallery on a completely independent basis provided for, but another object to which we have early directed attention*, the eventual establishment of a free public library for our citizens, substantially secured; and by a recital in the act, the services of Mr. Dargan, (the amount subscribed for the erection of a testimonial to whom has been appropriated by the committee to the construction of the National Gallery,) are commemorated by a mode of compliment the most marked, because the most unusual. The objects of the act (which may be regarded as a parliamentary form of conveyance or deed of trust,) were several, but they are shortly and intelligibly effected. Provision is made for the *building* of a National Gallery, within whose walls a proper portion is to be set apart for a great public library, the nucleus of which will be formed by the old collection formed by Archbishop Marsh, and now hidden in the neighbourhood of St. Patrick's Cathedral. A committee of seventeen Governors of the National Gallery is incorporated, with full powers as a perpetual corporation, independent of government and of all other public bodies. After the building is once erected, the functions of the trustees for *that* purpose are at an end, and the legal property in the *building* is vested in the two

* See the article on the Establishment of Public Libraries, page 40, *ante*, No. III. for March; and especially to the note at the end, (p. 46.)

Corporations of the National Gallery and of Marsh's Library jointly, for ever. Lastly, the fullest leasing powers are given to owners having limited interests to lease or convey land for a site in Dublin, and the difficulties created by Mr Sidney Herbert's limited powers with respect to Leinster Lawn, are removed not only with regard to the National Gallery, but also with regard to the Museum about to be erected by the Dublin Society on a portion of it.

§ 1. of the Act creates five trustees for the exclusive purpose of erecting the required building: The Earl of Charlemont, (President of the Irish Institution); Mr. Richard Griffiths, (Chairman of the Board of Works, who are to be the builders); Mr. George Roe, (representing the Dargan Testimonial Committee, and Chairman of that of the late Exhibition); Col. Larcom, V.P.R.I.A.; and Mr. Thomas Hutton, M.R.I.A. These trustees are empowered to receive money for the purpose of the *building* merely; and by § 2. to expend it upon the purchase of a site and the erection of the Building. It is through their hands that the sums subscribed for a Dargan Testimonial will be expended, and thus the Building will constitute that Testimonial.

§ 3. Empowers all owners of limited interests (of course including Mr. Sidney Herbert,) to make grants in fee-farm, or leases for 999 years, for the purposes of the act.

§ 4. Empowers the governors of Marsh's Library to remove that library to the building about to be erected, when complete, and (§ 5.) to dispose of their present premises after such removal; while by § 6. they are saved their exclusive control over the library as trustees of it, under their own act.

§ 7. Incorporates Seventeen persons and their successors for ever as an independent body corporate, under the name of "THE GOVERNORS AND GUARDIANS OF THE NATIONAL GALLERY OF IRELAND," with full powers to hold Land, Paintings, and in fact all other property necessary for their trust. These Seventeen persons consist of *five* ex officio governors:—1, the President of the Dublin Society; 2, the senior Vice President of the Dublin Society; 3, the President of the Hibernian Academy, (the head of the profession of artists in Ireland, and whose name *ought*, of course, to have stood at the head of the list); 4, the President of the Irish Academy, (the principal body representing the science and literature of Ireland); and 5, the Chairman of the Board of Works, (to which body the execution of repairs and all extensions of the building will be committed). *Two* members deputed from time to time, as vacancies occur, by the Hibernian Academy (§12) from artists resident in Ireland, the first two being (6,) George Petrie, LL.D., R.H.A., V.P.R.I.A.; and (7,) Thomas Francis Mulvany, R.H.A., (both members of the Irish Institution; and the latter, one of the zealous and admirable secretaries, by whom the business of the Committee has been so quietly and efficiently carried on). *Three* members appointed by the government, (and whose places are to be refilled up from time to time,) namely, (8,) the Earl of Meath; (9,) Col. Larcom, V.P.R.I.A.; and (10,) William Dargan, M.R.I.A., all V.P.'s or members of the Institution Committee; and the remaining *seven* members of the Board elected from time to

time, as vacancies occur, by annual subscribers of One Guinea, and donors of Ten Guineas* or upwards; or of Works of Art of the value of Twenty Pounds or upwards to the National Gallery; the first seven have been nominated by the Irish Institution, and consist of (11,) the Earl of Charlemont, (President); (12,) the Lord Chancellor; (13,) Lord Talbot de Malahide, M.R.I.A.; (14,) Sir George F. J. Hodson; and (15,) Messrs. Robert Callwell, M.R.I.A.; (16,) James Calvert Strouge; and (17,) J. E. Pigot, M.R.I.A.; all of them of the most active members of the Institution Committee.

§ 8. Empowers the governors so incorporated to receive donations and subscriptions of every class for the purposes of the gallery.

§ 9. Provides that the building to be erected by the building trustees, must be erected, *not* according to the taste of the Board of Works, (which is too well known in Dublin to need observation here,) but “according to such plans and specifications,” and so only as shall have been *approved of and “agreed upon by and between”* the Building Trustees, and the Boards of the Gallery and of Marsh’s Library, respectively. It is to be hoped that, by this clause, the public will be secured against anything very shocking in point of taste, either inside or outside the gallery.

§ 10. Vests the building, when complete, in the two last named Boards for ever: the office and function of the Building Trustees being then to cease altogether, that is, (may we hope,) in two or three years from the present time.

§ 11. Limits the term of office of all the Governors, except the *five*† ex officio members, to Five Years.

§ 12. Provides for the succession of Governors by the filling of vacancies in the manner above described, with respect to the election of seven members by subscribers and donors at large. It appears to have been feared by the framers of the act, that in case the National Gallery became rich, (either by public grants or otherwise,) this class would probably fall off, at least so far as *pecuniary* donations and subscriptions are concerned. Accordingly, a provision is inserted, by which, whenever on the occurrence of one or more vacancies, there happen to be less than One Hundred qualified voters, the government shall appoint in place of them; so that care should be taken that at least that number may be kept on the lists, in order to preserve to the general public the exercise of this very useful franchise, which *must* be exercised every five years, and will certainly, in the ordinary course of things, be so much oftener.

By this 12th §, a useful saving is inserted, by which any member of the Board, who ceases to reside in Ireland, ceases to be a member of it; so that we shall not have absentee members—names standing in the way of realities—such as under their settlement the Hibernian Academy are obliged at so much inconvenience to endure.

§ 13. Empowers the Board of Governors of the Gallery to make bye laws.

* It is printed “Two” in the act, by mistake.

† It is printed “Three” in the act, but here again by mistake. This mistake is, however, practically corrected by the next section.

§ 14. Provides power to the Governors of Marsh's Library to admit any other collection of books into the same building. Marsh's Library is a collection valuable as such only up to about a hundred and fifty years ago. By this section the Dublin Society and other bodies (why not by some arrangement the Dublin Library Society also?) *may* combine with Marsh's, to give us the practical advantage of a great and tolerably complete free public library. It remains to be seen how soon they will come forward, and who first, to take a part in so splendid a public work.

§ 15 is the Interpretation Clause, (without which English Acts, be it observed, would often be more apt to do the *reverse* of what their proposers designed, than anything else).

§§ 16 & 17. Provide powers to effect the conveyance of part of Leinster Lawn to the Dublin Society for their Museum. Under these sections Mr. Herbert may lease or grant the whole lawn to the Dublin Society, and then the Board of Trade may *divide* it between the Society and the Building Trustees of the National Gallery! [Such is the businesslike way in which the machinery of Parliament performs the simplest operation].

§ 18. Provides [urged by the doubtful necessity of the case] that "this act shall only extend to Ireland!"

This Act of Parliament appears to us so deserving of full note in our pages, that we have made room for it at the earliest moment. It is not, (and especially in its details,) all that we should desire, nor such as the present writer believes it might most easily have been made; however, the main features of the plan of the Irish Institution are carried out in it, and a very little of judicious management alone is required to oil the hinges of the apparently unwieldy machinery. We shall not, therefore, criticize it at present, save only as to the admission of the Dublin Society as an element in the new body. This measure seems to us to be as completely objectless as it is in point of taste and appropriateness altogether objectionable. We cannot understand the grounds upon which the President and senior Vice President of that Society should be members of a Board of an Irish National Gallery; and if anything could add to the objection to these appointments, it certainly must be the manner of naming those functionaries, as they are in the act named, before the President of the Hibernian Academy. We, however, cordially accept the more substantial portions of the enactment, and we have, indeed, only animadverted on this particular blemish, because it smacks of a system of selection in the construction of Committees in Ireland, which we have repeatedly already pointed out to the reprobation of well-judging men, and which we shall never wittingly omit to expose and condemn.

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ART. I.—*On National Education in Music.*

WE believe it would be unnecessary to occupy the attention of any readers of this Journal with a dissertation upon the importance of the cultivation of Music among a people, as one of the highest branches of learning in its effects upon the civilization of human society. The difficulties which beset our path in Ireland, in every exertion that may be made for the improvement of the peoples' lives and happiness, are not those arising from mere ignorance or stupidity: the general principles upon which such undertakings as ourselves and others have frequently insisted on are never denied, are indeed very generally recognized the moment they are asserted; it is here with apathy, rather than with want of intelligence, that the soldiers of Progress have to contend. But for him whose sphere is that of the Journalist, not the Ruler, for him whose business it must be to plead rather than to command, and to advise more than actually to do, it is but possible to set down in some intelligible form what appear to him to be the practical conclusions from principles to which no general objections can be anticipated, and to point out the means by which, in his judgment, a desirable object may be the most easily and the most effectually realized; he can then but hope that sooner or later some portion at least of his suggestions may receive consideration from those for whose benefit they are intended, and that in some form or other the seeds which he has sown may bear fruit. Accordingly the present writer, in asking the attention of the Irish people, or at least of those who have any influence for good amongst them, to the importance and facility of furnishing our population in general with a sound and extensive Musical Education, does not deem it necessary to enlarge upon the well known power of Music in softening and refining the rudest minds; nor yet upon the great value of such mental training as the study of the highly intellectual and abstract Science of Harmony must in its nature afford, like that of the Mathematics themselves; nor yet upon the many noble uses to which Music may be, and in most civilized countries is, applied; nor even upon the peculiar purity of that enjoyment which the practice of this noble art so richly affords, even to the uneducated. All these things are perfectly well recognized, and the example of the German nations and of Switzerland is constantly mentioned in society as attesting the importance of a general cultivation of music to the civilization, the peace, and the happiness of a community. We all know that the more of pure and

innocent pleasures we provide for the daily recreation of the people, the less likely will they be to sink into the vices into which uneducated idleness ever so surely leads; we know too that of all pleasures that of music alone is directly compatible with the hardest toil, and that it ever soothes fatigue and encourages and vivifies the labour both of man and beast. No one hesitates then to desire that the study and practice of Music were as general in Ireland as in Germany and Switzerland, or as in France, Italy, or Spain; and thus we cannot help indulging in a hope that, without staying to insist and enlarge upon the advantages of such a consummation, we may find our readers willing to consider practically the feasibility of a particular plan of operations towards this end, which to ourselves, after much consideration, does appear feasible, and even to the fullest extent of it. Without further preface, therefore, we proceed to make some notes upon this subject for their use.

The original resources of Ireland (and we may likewise add of the kindred Celtic people of Scotland) are, in music, infinite in extent. These treasures are almost confined to Melody alone, but in Melody they may, with little fear of challenge, be pronounced unequalled throughout the whole world. And wherever Melody exists and is honoured, there we may be perfectly sure that every branch of musical cultivation will rapidly take root when introduced, and richly prosper and extend itself in practice. Almost all the modern composers have helped themselves profusely from the stores of melody which their own or adjacent countries supplied, and not merely in the occasional introduction of movements into pianoforte or orchestral compositions, (as in Haydn,) but in the choice of arias for operatic works still more largely, and with greater success. Rossini has embalmed many local Italian ballads among his finest works; the "*Di tanti palpiti*" is, we believe, note for note, taken from an Italian peasant ballad; and again, the whole of the music of "*Il Barbiere di Siviglia*" breathes the most vivid recollections of Andalusian melodies. Weber (himself we believe a Tyrolean) is said to have borrowed even the chief part of his operatic melodies from the songs of the Tyrol and the *rânz des vaches* of Switzerland. Donizetti owes some of the most popular of all his songs to a similar source: the "*Com'è gentil*" is a well-known street ballad in Rome, and the magnificent "*Brindisi*" (Alboni's *chef d'œuvre* of song) is a Neapolitan melody, or rather one originally of Spanish origin transferred to the Spanish part of Italy. Boieldieu introduces our own *Eibhlín a ruín* (under the misdescription of an "*air ecossais*") into "*La Dame Blanche*," in whose overture it figures as the principal theme, though treated indeed in a way in which few Irish minstrels would recognize its meaning. And observe, that by this use of the melodies of Italy, the Tyrol, Switzerland, Spain, and France, those melodies themselves remain uninjured, and the national feeling of the people for them untainted. In Italy the delight of the population in the harmonious splendour of their unrivalled operas is indeed unbounded, but that same population is as much alive as ever, perhaps more alive, to the loveliness and value of their national melodies in an unadorned state. So in Spain, (where the Italian opera, sung either in Italian or Spanish, is every where almost as popular as in Italy,) the universal passion

for the simple guitar, and the unlimited practice of singing by all classes of the people of their own airs in the purest Spanish manner, seems rather to have increased than diminished. And in truth for a nation into whose soul Melody has ever entered, the love of Melody never dies. For Melody is the true language of the heart, and appeals to the grander as well as to the softer passions, kindling these in every shade of them with a directness and intensity which nothing else can approach in degree. Our reason is gratified most nobly by the intellectual magnificence of Harmony, our cultivated ears are soothed by the richness of its delicious combinations—but proudly as our souls are elevated (sometimes near to bursting with enthusiastic delight) by the unapproachable, we had almost said unimaginable, sublimity of Beethoven's masterpieces of scientific Art, yet in Beethoven too, it is the almost equally unfathomable depth of his overpowering melody that ever most entirely captivates our *hearts*, and we can hardly say that his glory is more dazzling in the brilliant splendours of the Battle Symphony, or that in C, than in the passionate softness of the Sonate Pathétique, or the almost Irish tenderness of the Adelaide, the queen of all existing Ballad Music. It is where the genius of Melody is most vividly present, it is there precisely that the cultivation of Harmony in addition—the Intellectual part in addition to the Spiritual—will produce the noblest fruits; there Musical Art may be expected to approach nearest to its culminating point: and if in Ireland, for five and twenty centuries, Melody has been cultivated as we know it was, and if to this day we have preserved among our people such countless and immeasurable riches of Melody as it is now well known we have, what may not be fairly expected from the right cultivation of our national taste for music and our national delicacy of ear, even though it be indeed true that the world cannot hope for another Beethoven, any more than for a second Napoleon over it?

If instruction in the science of Harmony, and the cultivation of the complete Art of Music, were necessarily to imply the sacrifice of the traditions, taste, and practice of our national melodies, we, for our parts, should deliberately condemn the introduction of such a branch of modern education into Ireland: for we feel there is nothing left us in the world which breathes so much of the special nature and individual character of the Irish race, or preserves it so purely, as those strains which have been handed down to us from the earlier ages of our history. But we have no fear of any such injury, and less than ever now, when at last so vast a body of that early music of every style and description of it has been successfully collected, and is now sure to be preserved for ever, owing to the exertions of the "SOCIETY FOR THE PRESERVATION AND PUBLICATION OF THE MELODIES OF IRELAND," established under the Presidency of Dr. PETRIE, R.H.A., two years ago. The first necessity unquestionably, was to secure from loss and oblivion the greatest possible quantity of that priceless music, which, in endless variety, still exists unwritten among the peasantry; to preserve every portion of it absolutely pure, as it is sung and played among the people, and so far as possible the *Irish* words allied to it in past generations; to note down under the direction of those perfectly acquainted with the spirit of Irish performance,

(totally different as it is in rhythmical character and expression from that of every other existing music,) the mode and style of singing and playing characteristic of the country; lastly, to collect and preserve every thing which could elucidate, and by or in connexion with which men could teach and learn, the Irishness of Irish Music of every kind. Much of this, it is delightful to know, is now being done by Dr. Petrie, through the medium of the society just named, and the immense collections of Irish Music at its disposal, his own alone including above 600 unpublished airs to begin with, will be printed as fast as the support which the Society may receive from the public will permit. The student of Irish Music, therefore, will for ever have the fullest opportunities of perfecting himself in its treasures, and the future Irish musician an inexhaustible source of inspiration at his hand. The education of the people in musical knowledge would be sure here to produce the same results as in Italy and in Spain, to make them enjoy more perfectly the excellence of these eternal possessions of their race: and the peculiar genius of the ancient national music may thus one day exert its noblest influence in guiding the tone and marking the separate character of a new school of modern music to take a place by those of Italy, Germany, and France, while the ballad melodies of ancient Ireland would still continue to be sung with ever increasing popularity in the midst of all other music, as those of Andalusia still are, even within the walls of the Italian Opera at Seville.

The people of Ireland are fully as capable of profiting by good instruction in Musical Science as any other Celtic people, as those of Italy, or of Spain, or of France; and the civilizing effects of music must surely be found in practice as important in Ireland as in Switzerland or Germany. The object of all education is to produce refinement, and to awaken and regulate the faculties of the human mind. There is no Art whose effect is more immediate than that of Music in melting down the rudest souls, in substituting the softer and finer feelings of our nature for the coarse dispositions which are induced by daily contact with the rougher scenes of common life. There is no Science in the prosecution of which, simple as it is, the attention of the mind is more necessary, and its faculties more habituated to exertion, than that of Music. It is, therefore, very important that this study should become a portion of the general education of every people, but it is peculiarly so in Ireland, because there is no soil in which the seeds of musical knowledge may be reasonably expected to thrive more surely or more rapidly than this of ours. It follows also that of the large sums annually applied to the education of the people a proportionate amount *ought* to be appropriated to this branch of it, and that measures should (and without further delay) be taken for the proper introduction of Music as a department of education in every school, from those of primary instruction to the college and the university. And it will appear, we think, that the expenditure of so small a sum as *five thousand pounds a year* would be sufficient to commence a large and liberal system of musical education extending over the whole kingdom, and capable of supplying all our wants in this department, at least for several years to come. It is to such a plan then that we desire, just now, to invite

attention, to invite criticism. We shall not stop to canvass the value of the suggestions included in it in detail, for the details of its parts may be arranged in many ways equally convenient; we shall but, as shortly as we intelligibly can, trace out the principal features and connection of a plan, such as to the present writer appears a feasible one, and we shall leave it to our readers, and especially those interested in the success of the great cause of Education in Ireland, in every department, to consider what improvements may be made in it, or what other scheme may be devised more likely to conduce to an object which we are persuaded only requires to be suggested, to command a general interest equal to that which we ourselves feel in its successful accomplishment.

The first step in a general system should consist of the introduction of the elements of music among the class books used, and as part of the weekly study, in all the primary schools throughout the country. The rudiments of harmony may be taught at the same time with those of arithmetic, to every boy and girl who is able to read, and with the assistance of a well prepared elementary manual the ordinary masters of every village school will be able to instruct their pupils in these rudiments. Thus the first step can be taken without any expense or trouble beyond the supply of a proper manual, and the adoption of it as part of their regular ordinary course of teaching, by the Board of Education and by the Christian Brothers, to be introduced into all the schools under their direction. The larger schools of this class (as for instance, those in the larger and richer country towns) would be capable of providing for a somewhat greater amount of instruction, as well as for some practice in Music; and for these some simple harmonies might be selected or prepared, in the learning of which the first principles of the science might be practically explained.*

In the primary schools, however, no considerable amount of special instruction in Music could (or indeed, in presence of greater necessities of education during the short period of a peasant child's education, *ought to*) be afforded. For those who might desire to prosecute their studies farther in this art, as well as for pupils of a somewhat more affluent class in the larger provincial towns, a superior kind of education must be supplied, and in academies devoted to this special branch of learning. Such secondary schools would certainly not be able to support themselves, at least for a considerable time, out of fees so moderate as those which it would be advisable to exact from the student in the infancy of a new branch of education, and before its practical value would yet be felt. But in order to produce the necessary efficiency of such schools as part of a national system, they must, from the very first, be placed on a liberal

* But where words are used care should be taken that those words should give expression to the national feelings of the Irish people. Words suitable in England are precisely the most improper here, and the admission of such airs and words as for their own purposes the English Government have caused to be introduced at Marlborough-street should be carefully guarded against (especially in the South and West). They find no home in the hearts of this people, and utterly fail of their intended purpose, that of bringing up the youth of Ireland in principles inconsistent with their well-known devotion to their ancient nationality.

footing. They must afford the best instruction procurable in the localities in which they are established, in at least the most necessary branches of musical education; and for this purpose the services of the best local teachers (provided they be capable of performing the duty satisfactorily) should be engaged at a suitable rate of remuneration, and that rate should be fixed at an amount which might allow of exacting from pupils but the smallest possible fees. Such a school in any good provincial town ought then to include three separate branches of practical instruction at the least; the theory of music, together with either singing, or the organ, or the pianoforte; the violin or violincello; the flute or clarionet, and the principles of wind instruments generally. Each such school should be supplied, therefore, with at least three regular masters, and if a salary of £50 a year be secured to each in addition to the fees (or a proper proportion of them) paid by students, the portion of his time thus occupied would be probably deemed by a musician already engaged in teaching in the same locality fairly paid for. Each such school would, therefore, cost, in round numbers, about £200 a year, allowing £50 as the rent of a proper house for the purpose; and such secondary schools ought to be simultaneously established in Belfast, Clonmel, Cork, Derry, Dundalk (or Drogheda), Galway, Kilkenny, Limerick, and Waterford, at least, if not in other provincial towns. The whole expense, however, of such a system of schools so distributed among nine of the principal towns would be only £1,800 a year; for any additional development required in Cork or Belfast might easily be borne out of the large amount of fees likely to be received in those rich and populous cities. The wants of the metropolis, with respect to a secondary school, could be provided for in the central Academy we are about to describe.

This system of Secondary Education would be abundantly sufficient for the general instruction of the people, and would serve to draw out such talent as might advantageously devote itself to Music as a profession and special means of livelihood and of distinction. But a higher special school would still be necessary to complete the education of the professional musician, and for this purpose an IRISH ACADEMY OF MUSIC should be established in Dublin, upon the same social footing as the Hibernian Academy, and accomplishing for the musical profession all that the Hibernian Academy might and ought to have accomplished for that of the Artists of Ireland. This academy should be conducted, in so far as it would be the chief *reunion* of the profession, by a President and members elected by, and so constituted as to represent, the Profession generally. It should, however, actively preside over the system of education, and the President and members might fill the professorships in the principal central school. Those Professorships should include separate chairs, in the first instance, in at least eight branches of education, namely: the Theory of Music; the Practice of Singing; the Violin; the Violincello; the Organ and Pianoforte; the Flute and Clarionet; the Cornet and horns; and the Trombone and Bassoons. The Professor of the Theory of Music should manifestly be the most accomplished musician of the day in Ireland, if possible, and his duties of teaching might be confined to the delivery of the necessary course

or courses of lectures on the theory of music every year, while it might be a part of his office to act as the conductor of such performances as should be undertaken by the Academy in the course of each season. The salary of such a professor might be fixed at about £300 a year. The other professors would be fairly paid in Dublin by a salary *averaging* £100 a year each, in addition to the whole or a proper proportion of the fees of their respective classes; and the instruction of pupils in the Dublin Secondary School (that is, of pupils less advanced than those intended for the profession) might readily be conducted by the same staff. The entire expense of this central academy would thus be about £1,200 a year, (allowing £200 a year for the rent of a proper house in Dublin for the purposes of such an establishment,) and this sum, in addition to the £1,800 required for the nine provincial schools, gives the very moderate amount of £3000 a year for the necessary support of a national school system.

In connection with the foundation of a complete system of musical education in Ireland, however, arrangements should also be made from the first to make the best use of it in practice. The smallest cities in Germany have their regular operas, besides concerts and oratorios frequently throughout the year. In Ireland also we ought to have an opera, supported by efficient local talent, and conducted on the moderate continental scale of expense, not only in Dublin, but in (at least) Cork, Belfast, and Limerick, among our provincial cities. The establishment of a regular Opera keeps a certain number of trained musicians together, and makes every other kind of music easy of access; so that if it be important to accustom all classes of society to the enjoyment of good music of every kind, it is especially important to provide for the permanent establishment of an Opera; and if such an establishment be placed under the direction and control of a National Academy of Music, it may be most easily preserved from the contamination which the evil taste of the fashionable world obliges the managers of ordinary theatres to provide for the public. We should therefore insist on the establishment of an Opera at least in Dublin—it may be small in extent to begin with—under the censorship and control of the Academy of Music, and in which the students (and perhaps some of the teachers) of that institution might be secured frequent, if not constant, employment; the Academy would soon naturally become the source from which performers as well as teachers, throughout the country, would be sought for every purpose connected with Music. In addition to the Opera, the Academy itself should hold public concerts and oratorios occasionally throughout the year—and not only in Dublin, but alternately in the chief provincial cities, with the assistance of the staff of the provincial schools—under the conduct of the Professor of Music, and with the co-operation of the professors; such concerts and oratorios being made the means of introducing to the public the higher class of classic compositions, old and new, which might best serve to raise the standard of pure taste, and point and direct the studies of the schools throughout the country; nor should the practice of pure Irish music be lost sight of on these occasions, nor the Academy neglect to emphasise the beauties of our national melodies, and to point out how rich a source of inspiration is always to be

found among these treasures of ancient art. Lastly, after a few years, regular Musical Festivals might be held triennially, or even annually, in various parts of Ireland, and prizes held out to students and musicians of every class for competition—prizes valuable enough to excite the utmost exertions, and honoured enough to inspire the highest zeal—prizes which should, however, be open to all comers, that so an opportunity might be afforded to every hidden talent to obtain recognition, and be placed on the way to prosperity and fame. Such a system, adopted as a whole, would supply a healthy stimulus to exertion in a new walk of civilized life, and ought, even in a few years, to produce fruits of every kind, in the production not only of accomplished performers, but eventually of successful composers, able to compete with the richest of those of the Continent. And when, years hence, the first attempt shall be made to place an original Irish Opera on the stage, the composer will do well to dismiss from his mind everything which may lead to the degradation of an English *libretto*, such as the worse than silly productions which have satisfied London taste in our own time; and remember that in the old Irish language itself, correctly treated, (as we could easily show, if space and the occasion permitted,) he will find a vehicle for music yet softer than the Italian, grander than the Spanish, and more flexible than French, or of course than German—one, too, very easily learned by the singer, and infinitely more easy of pronunciation *in song* than any existing European tongue. This power of our language is not yet indeed recognised, but the present writer is well assured that it only requires a little investigation, or a few examples, to convince the most sceptical of those who, ignorant of the Irish, will probably smile at the suggestion here made—a suggestion, the force of which will be acknowledged by those of the educated classes who have made even but a superficial acquaintance with the Irish language.

We have now sketched the means by which musical education may be introduced into the existing primary schools—(the necessary manuals might be prepared or approved by the Academy of Music)—and that education enlarged in the nine Secondary or Provincial Schools, and finally brought to completion in an Academy in Dublin. Arrangements should also be made for the attendance of clever and advanced pupils of the primary schools at the classes of the secondary, and for the drafting of the best pupils of these again to the Dublin establishment. And it is in these arrangements chiefly that we should propose to expend the remaining £2,000 a year, out of the £5,000 which we began by declaring a proper sum for the establishment of a worthy national scheme of Musical Education. Besides the opportunity which the presence of the provincial schools in nine principal towns would give to the numerous pupils in the schools of the Board of Education and of the Christian Brothers in those places, of attending the higher establishment, (for which facilities should be provided for those likely to benefit especially by such attendance,) there should be means set apart by which the most intelligent scholars at the village and rural primary schools might be enabled to devote themselves to attendance at the secondary musical academies, as well as at such other schools as the larger provincial towns afford. The authorities presiding

over the primary schools would easily find means to discover such students as may exhibit any peculiar aptitude in this direction, and as the expense of support in the provincial towns is very trifling, a small sum by way of Scholarship or Exhibition would abundantly secure to such students the desired opportunity for a year or more. For this purpose we should not consider £1000 a year too large a sum to be appropriated. Again, it would be equally necessary to provide means (by way of prize or reward) to enable the most distinguished students at the Provincial Schools to prosecute their studies at the Dublin Academy, with a view to complete a professional education; and to accomplish this end, we should propose the establishment of ten annual Academy Exhibitions or Scholarships, of the value of say £50 each, one for each of the nine provincial, and one for the Dublin Secondary School. Lastly, the Academy should have the means of sending to and keeping in (or assisting to reside in) Italy or France at least one advanced musician from among its senior scholars, and £100 a year should be placed at their disposal to be thus appropriated. The remaining £400 a year, we believe, would be best spent in conveying assistance, through the Academy, to the permanent Opera and Concert staff in Dublin, by dividing it into bourses, or payments by way of salary or part salary, to the staff of performers, and thus assisting in keeping up a certain number of definite offices to be filled by musicians, and enabling the managers of the Opera to open that establishment at a cheaper rate to the general public, for whose refinement and education the whole machinery of the system is in fact designed altogether.

One of the indirect advantages of the establishment of a National Academy of Music in Dublin has yet to be noted, and that is, the general dissemination of good music of every kind, which with little trouble it may be made the means of accomplishing throughout the country. Where a people know how to read, they must be supplied with books. Where they know how to read music, they must be supplied with music to read. In France, Germany, Switzerland, Italy, Spain, music is printed in various beautiful forms, and extensively sold at very cheap rates. Here an absurd system of printing (imported from England) still rules; and a very stupid—if not dishonest—system of extortion on the part, not of printers, but of music-sellers, makes it impossible for men of moderate means to buy at anything like their fair value the music sheets that are printed. The Academy would remedy this by establishing a first-rate music press, with all apparatus for both type and punched-plate printing, an establishment which itself would pay very well. There the best classic music of every kind should be printed and it might be sold from the first (for we have calculated it minutely) in pieces at about *one-tenth* the cost of music as now published. Such music might include every variety of song, as well as of instrumental pieces; and if publishers were fools enough to combine against such an undertaking (though they need not be interfered with as to *contemporary* publications), the Academy would find means, through the various musical schools over the country, to preserve their independence of the efforts of the trade.

Many other indirect benefits occur to us as likely to arise from the foundation of the proposed academy, but we confine ourselves to this one,

as an obvious one not hitherto suggested, and which indeed might easily be attained in connection with any movement which should excite general interest among the cultivators and admirers of the musical art.

We have now, however, completed our sketch, and shall not any longer detain our readers. The object of this paper is not to press the adoption of any pet scheme, but only to ask attention to some propositions, which the writer only desires to offer as his contribution to assist in some serious consideration of the whole subject. Only let us not have petty peddling plans undertaken for carrying out that which must be largely and liberally done, if at all; let us, if necessary, perform such a work gradually, but let us from the start keep before our eyes its necessary development, and not content ourselves with anything short of the ultimate completion of a system, which, to be effective, must be large and comprehensive.

ART. II.—The Census of Ireland for the Year 1851. Part III. Report on the Status of Disease. Presented to both Houses of Parliament.

IN this very valuable and important memoir, embracing one of the special inquiries of the Census of 1851 into the condition of the population of Ireland, it has been attempted to give a view of the actual hygienic state, the absolute numbers and relative proportions of the healthy, the sick, and the infirm, at a certain day and date, of a population of known amount, and living under tolerably well-defined conditions of latitude, soil, and climate. Such an investigation is of far deeper importance and of more immediate value to the interests of the community than may be apparent at first sight. We are as yet but very imperfectly acquainted with the laws which regulate the physical development of the human race; the causation of disease, and the conditions which favour its production, are still very obscure. Yet it cannot be denied that health is impaired, disease induced, and life shortened, in innumerable instances, by circumstances which it would be possible, in some degree at least, to control, perhaps to obviate altogether. Some advance has been already made in this respect, for there is good reason for believing that the mean duration of human life has been appreciably increased within late years. And when we shall have obtained more sure data for estimating the conditions which favour its prolongation, as well as for obviating those which induce disease, a still further increase may be anticipated. The most important preliminary step in this great scheme of social progress is to determine, as far as may be possible, the actual conditions of health and disease of the population at a given period. The results thus obtained are of value, not only as viewed absolutely, but also as standards of comparison in future inquiries. The tables of the Irish Census Commissioners in the memoir before us, present us with the results which have been obtained with regard to the state of health and disease of the people in this country.

The extent of the labour requisite for the successful prosecution of this investigation can only be appreciated thoroughly by those who examine

the masses of facts and figures from which the conclusions are deduced. The inquiry comprises not only the ordinary forms of acute, chronic, endemic, and epidemic diseases, but also all those abnormal conditions, whether congenital—that is, existing at birth—or subsequently acquired, such as blindness, deaf-muteism, deformity, lunacy, idiocy, &c., which are found in certain individuals, who may be otherwise in the enjoyment of more or less perfect health. Such an inquiry, whenever prosecuted, will shew by its numerical results the actual state of health of a particular population at a given period of time; and by careful consideration of the data thus furnished, due allowance being made for the influence exercised by temporary or accidental causes in raising or lowering the figures assigned to each group of diseases, we shall be able to arrive at a standard expression for what may be denominated the *Normal Constants of Health and Disease* in a given people, in a given country, at a certain date, and living under known physical, physiological, and social conditions. Independently of their scientific interest, the results are of value, as furnishing the only correct standards for the comparison of healthy and diseased conditions in different countries and races, when sufficiently extensive researches shall have been carried out elsewhere; they are also of use, as offering the best criterion for estimating the “status of disease” at different periods of time. In a public point of view these results are of the highest practical moment, as on them alone can be properly based all future operations of the legislature in forming measures for the preservation of the public health. They also form the foundation for all calculations respecting life insurance, as regards both healthy and diseased lives. It is therefore with extreme interest that we have perused the able and comprehensive memoir of the Irish Census Commissioners, which we believe has been mainly drawn up by Mr. W. R. Wilde, the distinguished oculist, of this city.

The report is divided into nine sections, as follows:—Section 1 comprises the *Deaf and Dumb*. 2. *The Blind*. 3. *The Lunatic and Idiotic*. 4. *The Lame and Decrepid*. 5. *The Sick in Workhouses*. 6. *The Sick in Hospitals*. 7. *The Sick in Prisons*. 8. *The Sick in Asylums*. 9. *The Total Sick in Ireland*. As far as our limited space will permit, we purpose to exhibit some of the chief and most interesting numerical results obtained in the inquiries under these several heads. The first relates to the deaf-mutes. To obtain the requisite information on this subject, a very full but simple and well-devised form of queries was issued by the Commissioners, and to shew the excellent manner in which an inquiry of such a delicate nature must have been conducted, and how it was received by the community at large, we may refer to the words of the report, in which it is stated that in one instance only was the requisite information refused. After careful examination of the returns, it was found that the total number of deaf and dumb amounted to 4,747, of whom 2,688 were Males, 2,059 Females; of this total, 3885 (2,224 M., 1,661 F.) were born deaf and dumb; 535 (289 M., 256 F.) became so after birth; of the remainder, chiefly mendicants and itinerants, no further information was obtained. Of those actually deaf and dumb, 467 (256 M., 211 F.), consisting of 257 congenital and 116 acquired cases, were idiotic, paralytic, or both. Much

precaution was used in the collection of these returns, a medical examination having been made in all doubtful cases; precautions were likewise taken to exclude all the source of error which usually attend the narratives of parents and relatives; so that the results now presented in the Irish Census may claim to be ranked amongst the most perfect that have ever yet been attained in any similar inquiry. In a series of tables, constructed with much care, we have exhibited the numbers of the deaf and dumb in the several provinces, counties, cities, and towns of Ireland, the proportion of males to females, the ages and sexes, the occupations of the deaf and dumb, and also those of their parents; the proportion and position in each family, the evidences of hereditary influence or family peculiarity, and the causes, ages, diseases, and accidents which produce deaf-muteism in the non-congenital cases.

From the particular investigation of certain cases some valuable facts have been elicited, which support the views now held by the best recent observers, that a form of dumbness exists, independent of deafness, under certain conditions not yet well understood. This idiopathic dumbness is illustrated by some of the cases given at p. 25; in considering this class of affections, it will be necessary to exclude those instances in which the muscles of the tongue share in a paralysis more or less extensive; cases 33, 154, 115, 118, in Mr. Wilde's report are very interesting, as tolerably perfect examples of this idiopathic muteism, or dumbness uncomplicated with deafness; in three other cases the muteism was very probably paralytic, certain motions of the tongue being imperfect, the upper extremities, face, and tongue, being paralysed in one of them.

What may be the mode of production of this particular form of muteism not dependent on acquired or congenital deafness, is at present not determined; but perhaps the most interesting consideration in connection with it is, that there seems good reason to believe that it is not by any means incurable, and that with well directed efforts we may be able, in many instances at least, to bring our unhappy fellow-being so afflicted to the enjoyment of that noblest of God's gifts, the power of speech. To have proved this is only one amongst the many claims of the noble-hearted and philanthropic Guggenbuhl to mortal and immortal rewards. Dr. Guggenbuhl has established the fact, that a great number of the afflicted creatures known as "Cretins," affected with muteism, are not deaf, but, on the contrary, possess a very fine sense of hearing, and are capable of being taught to speak. "*J'ai vu à l'Abendberg,*" says Niepce, "*quelques-uns de ces crétins qui jusque-là n'avaient fait entendre que des hurlements, ou une espèce de grognement, et qui étaient parvenus à les remplacer par des sons articulées qu'ils prononçaient très bien.*" These are most encouraging results to the humane and charitable engaged in the noble work of instructing the deaf and dumb. The further results contained in this portion of the report exhibit the moral and mental state of the deaf-mutes, and the number and extent of the charitable institutions established for their maintenance and education. The proportion of educated to uneducated is as 1 to 4·57.

The second portion of the inquiry relates to the number and condition

of the Blind. The total number of blind in Ireland is returned as 7,587 (3,588 M., 3,999 F.), giving a proportion to the total population of 1 in 864. This section contains five tables, which furnish much highly valuable information as to the proportion of civic and rural blind in the several cities and counties of Ireland; the ages, sexes, and previous occupations of those thus affected, their state of education and marriage, the amount of accommodation in various asylums, and the varieties of diseases and accidents, together with the colour of the eyes in a large number of instances. According to the provincial summaries, Connaught presents the least, and Munster the greatest, number of blind in proportion to the population. By a comparison with the statistics of other countries, Mr. Wilde deduces that, with the exception of Norway, Ireland presents the greatest number of blind in proportion to the population. In the present state of the subject of vital statistics in Europe, we think these comparisons are, to say the least, premature; and in this and other portions of the report in which such comparisons are instituted, we regret to be obliged to say that we think Mr. Wilde has not exercised that care, judgment, and discretion which so highly important an investigation as that of the comparison of the parallel vital statistics of different countries requires. The machinery of the Irish Census enumeration is in a state of most remarkable efficiency, admittedly superior in some respects to that of the English; the results are quite recent, and are perhaps as near an approximation to the exact truth as may be ever expected in such an inquiry. The results in other countries are taken from inquiries made at periods more or less remote, some as far back as 1840, and some, we suspect, even less recent; there is reason to think that many of the investigations in question were made with a very imperfect machinery, and that a very considerable proportion of the cases, whether blind, lame, deaf and dumb, or lunatic and idiotic, thus escaped notice. It is certain likewise that there is much want of uniformity in the statistics of particular countries as quoted by different writers. A comparison of results obtained by a rigid inquiry such as that of the Irish Census of 1851, and those of other countries made at various antecedent periods and with ineffective machinery, is consequently of no value. The English returns under this head were not issued till after the publication of the Irish "Status of Disease," and the elaborate investigations which they comprise cannot be compared directly with those of the Irish Census.

At this and another part of the report (see pp. 45 and 69) some very inconsiderate statements call for the gravest censure: we allude to the passages in which it is attempted to be established that the inhabitants of Ireland always presented an unusual amount of abnormal physico-physiological conditions, such as blindness, lameness, deformity, &c. Such a passage as the following, unless supported by the most incontrovertible data, cannot be too severely reprehended, when put forward in a work having the stamp of official authority, and further enhanced by the scientific position of the writer. At p. 45 we find the following passage:—"That this country has always presented a large number of blind may be gleaned from several passages in the ancient records and annals. Giraldus Cambrensis

says, that "so many persons born blind, so many lame, so many deformed, so many wanting some of nature's gifts, I never met in any other land." It was not without infinite surprise that we found Mr. Wilde relying on the authority of Giraldus Cambrensis for any statements respecting the inhabitants of Ireland. As a man of science, a scholar, and an antiquarian, Mr. Wilde would have required but little consideration to convince him that the passage here cited, especially if judged by the context, was only one of the numerous malicious and wilful fabrications of this writer. The statement is entirely opposed to the testimony of all the writers who preceded and followed Cambrensis; and so far from the statements of Cambrensis and Mr. Wilde being supported by records and annals, the contrary is the fact, for exclusive of the Irish authorities, who may perhaps be suspected of partiality, all the English writers are unanimous in their account of the physical perfection, strength, and beauty of the Irish race. The following passage, backed by the double authority of Camden and Good, the former quoting from the latter, and both anything but partial judges of the Irish, is in itself quite sufficient to overthrow the statement of Giraldus. Good says:—"In universum, gens hæc corpore valida, et imprimis agilis, animo forti et elato, ingenio acri, bellicosa, vitæ prodiga, laboris, frigoris et inediæ patiens," &c. &c. We could cite numerous authorities to the same effect, and many passages in Cambrensis' own works contradict the statement in question. Had Mr. Wilde contented himself with merely citing the statement of Cambrensis, we should have only thought it evidence of bad historical acumen and worse taste, but would have deemed the matter entirely unworthy of notice, so well is the character of this writer known to all in any way conversant with Irish history. Not only, however, does Mr. Wilde himself endorse the statement, as we have just seen, but in a subsequent page he refers to this quotation as to the undisputed opinion of an authoritative historian. At p. 69 he says:—"We have already referred, at p. 45, to the ancient authority for the great number of lame and deformed in this country." We regret to have to point out and mark with censure such rash, inconsiderate, and unfounded statements in a work of the scientific pretensions of the "Status of Disease." But we feel bound in justice to say, in direct opposition to the assertion of Mr. Wilde, that there is no authority whatever for believing that the proportion of abnormal physico-physiological conditions was unusually great amongst the Celtic race in Ireland; and that, on the contrary, the direct testimony of all credible writers is opposed to such a belief.

The third and fourth sections of the report are occupied with the Lunatic and Idiotic, and the Lame and Decrepit. The results with regard to the Lunatic and Idiotic are based chiefly on the reports of the Inspectors of Lunatic Asylums. It is much to be lamented that these gentlemen have not taken measures, in obtaining returns of the class so-called "Idiotic," to distinguish between the "Idiot" and the "Cretin" properly so called, in conformity with the more advanced and scientific views now entertained on these subjects. The distinction is one of the highest interest to humanity, as in very many instances the perhaps deformed "Cretin" is curable, and capable of being educated so as to become an independent and useful

member of society, while the idiot (sometimes even with the best possible physical development) is generally in an almost irremediable state as regards his mental faculties. These distinctions are yet but little known in this country, and much ignorance prevails on the subject, an idea being entertained that "Cretinism has something to do with goitre," while numerous continental investigators, and more particularly those of the Sardinian Commission, have convincingly shown that only about one-third of the Cretins are affected with goitre. We recommend this subject to the consideration of the Irish authorities; it is one of immense importance, when we take into account the possibility of effecting a permanent restoration to the use of reason of even a small proportion of those who are now known as "Idiots."

We regret much that our limits will not permit us to enter further into the consideration of this valuable report on the "Status of Disease" in Ireland. The sections on temporary diseases are ably drawn up, and should be consulted by all interested in the statistics of disease. We have here a basis of comparison for the results obtained in other countries and in subsequent times, and the value of such a standard cannot be too highly estimated.

ART. III.—NOTICES OF BOOKS.—*A Practical Treatise on Mine Engineering*, by G. C. GREENWELL, Colliery Viewer. 4to. Parts 1 to 12. Price 2s. 6d. each. M. and M. W. Lambert, Grey-street, Newcastle-upon-Tyne. 1853 and 1854.

It is a singular circumstance that up to the present moment there does not exist in the English language a good scientific and practical treatise upon mining; indeed, until very recently, there did not exist a work of any kind upon the subject. The same may be said of the equally important branch of industry, metallurgy. Hitherto this want was not sensibly felt, for, in the first place, the majority of the persons engaged in these departments have been, and are still to a great extent, men almost wholly unacquainted with science, and who work by a blind routine. And in the second place, the immense mineral resources of England, their admirable geographical position, and that of the country itself, relatively to other nations, gave to England such advantages over other countries, that rigid economy of production could be disregarded. The reverse of this was the case on the Continent. Science conferred so many benefits on industry in France during the first French Revolution, that its importance as an element in industry was at once recognised on the Continent. Another cause has largely contributed to bring about this result—namely, the comparative poverty in mineral resources of most Continental Nations as compared with Great Britain, and the absence of that happy combination, which, joined with its unrivalled geographical position, has placed the latter country at the head of all commercial nations. Skill and science had to make up for the want of natural advantages, and this they have so effectually done,

that France, Germany, Belgium, have at length become formidable rivals of British trade.

The extraordinary growth of material civilization now taking place, and the basis of which is mineral wealth, has created a still greater demand for coal and the various metals, and impressed upon the public mind the necessity of economy of production. Men are beginning to understand that in order to obtain a certain quantity of coal, it is not necessary to waste a still greater quantity; that in order to work deep mines, it is not necessary to destroy the strength of the workmen in climbing hundreds of fathoms of ladders, or making them breathe a stifling, noxious atmosphere. Societies have been formed for the promotion of knowledge connected with mining, and schools for the special education of miners are beginning to be established. Among the former we may specially mention the "North of England Institute of Mining Engineers," at Newcastle-upon-Tyne, under whose auspices several valuable contributions have been made to mining knowledge. In connection apparently with this institute, a College of Industrial Science has also been established at Newcastle, in which lectures are given upon chemistry, mining, &c.

The lectures upon mining were given in 1852, by Mr. G. C. Greenwell, and these he has now made the basis of a large illustrated work, which is being published in parts at 2s. 6d. each, under the title at the head of this notice. The object of the author is to provide a manual for the use of mining students and of mining engineers, who have not had an opportunity of acquiring previously a scientific education, which he from experience justly considers of the highest importance. It is because of this laudable object that we notice the book, and because it is a pleasing indication of the progress which is taking place among the mining classes. More than this we cannot say of the book, for although rather expensively got up and profusely illustrated with plates of sections (each number has four), it is not the kind of book which we had expected. The first chapter, which occupies more than six numbers out of about fifteen of which it is to consist, is devoted to the application of geology to mining, is written in a very rambling and unconnected style, and shows very little acquaintance with the present condition of science. The statistical data are borrowed from writers who have lived half a century ago. The third chapter is altogether upon metallurgy, and that too of so elementary a character that much more information might be obtained from Chambers's *Information for the People*. Mr. Greenwell is evidently a practical man, and accordingly much information of value is to be found in the fourth chapter "on boring for coal," occupying part of No. 9, and the whole of Nos. 10, 11, and 12. Even here, too, there is a want of system and logical arrangement, which is much to be regretted. Judging from what has been published, the work will be more likely to be finished in 100 numbers than in 15.

As unpretending lectures the contents of the book would be of service, but as an expensive and pretentious treatise on Mine Engineering, we do not consider it, we regret to say, of much value, and think Mr. Greenwell has entirely failed to effect his laudable object.

JOURNAL OF SOCIAL PROGRESS.

ART. I.—*On a general system of Art Education in Ireland.*

WE have repeatedly had occasion to insist, in this Journal, on the general importance to every people of some systematic education in the principles and practice of the Fine Arts; and we have pointed out how especially fruitful any well ordered system of Elementary Instruction in Art would at once become in Ireland, in consequence of certain direct tendencies of the Irish mind, which, strongly disposed as it is to what is abstract in thought, but at the same time definite in expression, needs but the advantages of skilful and correct training, and a pure direction, to attain very high results in this department. We shall not here recapitulate the reasons upon which such an opinion and such expectations founded upon it are based. The taste of even the most uneducated of the Irish peasantry (and we should expect to find the same among their Celtic kinsmen of Scotland, Wales, and Cornwall) for the pure mathematics, is very well known to all who have had any opportunity of observing it; and without going further at present, we may remark that it is precisely with such a taste we might expect to find a natural talent for *drawing* allied, since there is no study which better accustoms the mind and eye to definite and correct ideas of *forms* and *proportions* than that of the pure mathematics. If then the ancient Greeks were, and the modern French are, distinguished from among all their cotemporaries by their special delight and general proficiency in Geometry, we know them to be equally remarkable for ability in Drawing above all other nations, and we may reasonably assume that the people of Ireland would exhibit the same species of ability if their powers were equally cultivated, and their tastes were afforded equal opportunities.*

And it is not merely for the student who intends to become a professional artist, nor yet only for him whose easy circumstances in life may permit his making acquaintance with Art as a mere accomplishment, that

* The above remarks apply, of course, strictly to *Drawing* (what the French call *dessin*) and Perspective only, and not to the other branches of artistic education, such as Colouring, Composition, &c. But the foundation of all true success in the Fine Arts consists precisely of Drawing and Perspective, and in dealing with the subject of national education in Art, it is not thought necessary particularly to dwell on the superstructure of the system, where special branches of education would be provided in Academies for the small number of finished students, out of which the Profession of Painters would draw candidates for original reputation and lasting fame.

it is important for the nation to provide adequate means of accurate and tasteful education, though in the opinion of the present writer at least, it were well worth the pains and expense of a great national educational establishment, could even but a few true artists be the fruit in each generation. Outside the circle of candidates for professional rank, (who must be ever few,) outside the comparatively narrow circle of the affluent in search of mere accomplishment, a far more ample sphere extends, in which Education in Drawing is destined to lead to important practical advantages. Almost every trade, almost every manufacture, will derive from the practice of Drawing an accuracy and completeness now unknown to it, while from the ideas imbibed in the course of even an elementary education in the first principles of Art, (guiding as these must every form of Ornament and ornamental work—and what work is wholly free from some attempt at ornament?) the workman and his manufacture will draw something of taste and beauty, qualities now so very rare, yet, with a view to anything like real civilization of life and manners, so indispensably necessary. To the Carpenter and the Cabinet-maker, to the Builder and the Mason, to the Machinist, to the Artizan, in short to the workman in every department of manufacture, some suitable education in Drawing is absolutely necessary to the proper practice of his trade—how much more of such an educational element, and better than any now procurable in Ireland, would be requisite, if our artizans would in any way improve in their employment—how much more, and how much better still, if in point of elegance and good taste they would vie with the productions of neighbours provided with such educational advantages as the French, and even of so many other nations on the Continent.

In this country, however, we have had almost no education in Drawing, and that which does exist is unfortunately meagre in extent, and miserably inferior in quality. Every Irish artist we know of has been either wholly or almost wholly self-taught, and the people at large have, of course, neither opportunity nor inducement to struggle into this kind of knowledge. In this country, therefore, it appears to us to be clearly necessary to make Elementary Drawing an invariable part of the Primary Education of the people. Already, indeed, the want of it has so far been felt, that this department of study has been partially introduced (generally under inefficient direction) into a few schools of the Christian Brothers, and, with somewhat better result, into the Dublin School of the Board of Education; and in both cases the motion is doubtless one in the right direction. But the wants of the country require a great deal more than this, nothing less, in short, than the introduction of Elementary Drawing into *all* schools of Primary Education throughout the island, and as part of, and inseparable from, the course of education practised in them. And this first step would be as easy, as in a late number of this Journal it has been shown would be the addition of the rudiments of Music to the ordinary course of instruction at these schools; for with the help of a good elementary treatise, (which may be very easily procured, provided we do *not* go to the Board of Trade for it,) the rudest village schoolmaster may easily direct the elementary essays of his scholars. This part of a general plan would be

the foundation of all the rest, and this part of it may be put in operation at any time by the existing Educational authorities, and without any additional expense to their present system.

Opposite in the scale to the Primary Schools, or those in which the first rudiments of Drawing should be taught, and as the ultimate development and completion of a national system of Artistic Education, would in a perfect system, stand a College or Academy devoted entirely to special instruction in the Fine Arts in those higher and more difficult branches, requiring the exclusive devotion of the student. It is in such an institution that the professional artist would seek, and ought to find, the last instructions in his Art; and after there concluding a complete course of study, he ought to be able—so far as education can ever make him able—to compete with the original artists of his day. Such an institution should supply the highest and most perfect training, and should be carefully and constantly conducted by the ablest and most accomplished artists in the country; but in Ireland, at present, the only substitute for such a College is the chartered “Royal Hibernian Academy,” a body which is notoriously inefficient, if it is not indeed, as at present constituted, even absolutely incapable of ever becoming really effective.

The constitution of most “Royal Academies” has been found almost altogether unproductive of really valuable educational results, and these bodies have often been condemned by competent authorities on the subject, as tending rather to injure and retard, than to foster and direct the advance of general taste and the successful prosecution of professional studies, and as obstructing rather than promoting the spread of artistic education. It appears to us, indeed, that the general failure of the chartered academies arises, in some degree, from the abuse, rather than as a direct consequence, of their constitutions; but it is certainly true, that hampered as these bodies are by a variety of extremely ill considered, useless, and embarrassing restrictions, which, being incorporated with their charters, cannot be shaken off, it would often be difficult for them to realize any measures for the effective execution of the educational trust supposed to be reposed in them. Thus the Hibernian Academy (to take an instance from ourselves) consists of Fourteen Academicians, among whom Sculptors must, and Architects may be, and generally are represented, to whom is committed the undivided property in and care of the establishment; but besides these fourteen Academicians, there are also Ten “Associates” of the Academy, and vacancies among the Fourteen can only be filled up from out of the Ten, who may thus be considered as probationary members of the Institution. The Academy (that is, the council of Fourteen) is a self-electing body, having the sole power of filling up its own vacancies; and it also alone appoints to vacancies among the Ten Associates. Again, when once any person is elected an Academician or an Associate, he cannot be removed, even though he should cease to live in the country, or to care for the establishment. The natural consequence of such a constitution is, that this close corporation ceases in reality to represent the profession at large—that it becomes accordingly “suspect” to the profession at large, and assumes an attitude apart from, if not in hostility to it—that its tendency

is to the establishment of exclusive cliques and coteries, and that everywhere (but especially in a country in which, as here, there is at best but little artistic strength to bear dividing) the Academy is by no means sure to include the available talent of the population, and is thus only too well fitted to fail as an educational institution. And the practice of such an Academy proves that it does fail. There exists no hearty interest in its success, even among its own members, who have, or act and think as if they had, no responsibility, while they do not recognize any relation as existing between them and the so called Students. These "students" themselves consist of strangers, who are permitted to draw from a collection of casts from the antique, and who are permitted to draw and paint from living models supplied by the Academy, and nominally under the direction of a Visitor; but there is no regular instruction at all, no authority over or direction of the students, no educational discipline of any kind; and in the rotation of Visitors—an office filled by the academicians in turn—and of Keepers, (the Keeper also an Academician, bound to reside in the house, and in virtue of his office Master of the Antique Academy,) it is often to a person incapable of directing these schools at all, that the duty of educating falls, for the Visitor or Keeper may happen to have been devoted to some special subject quite apart from those which he is called on to criticize and explain. Lastly, should the few competent members neglect to perform their duty as Visitors, or even choose not to enter the schools at all, the Academy has no power (and the close corporation has no inclination) to remedy the inconvenience.

Such are some of the faults practically inseparable from the existing system and constitution of a Royal Academy of Art. Remedies will suggest themselves to every reader of these lines, remedies more or less efficacious. But we are conscious that, within the circle of existing members of the Hibernian Academy, there are one or two, at least, who are fully alive to the necessity of procuring a total change both in the forms and the working of that establishment, and we should prefer to see a proper plan of reform emanate from the Academicians themselves, whom the public attention just now directed to the subject of education in Art, will probably awaken to a sense of what is expected from them. We shall not, therefore, at present, offer any specific suggestions of our own upon the alterations necessary in that corporation, but content ourselves with shortly explaining what we believe a national Academy of Art *ought* to be, and may easily be made to be, in Ireland.

The sphere of such an institution—standing as it should at the head, and forming the ultimate development of a general system of education in Art throughout the country—excludes the idea of anything like mere elementary instruction within it. The students of such an Academy should be already proficient in all the special studies preparatory to the practice of Art. They should be accurate in Drawing, familiar with the principles of Perspective, and acquainted with the principles of Colouring and with the properties of Colours, as well as practically accustomed to the use of them. It is only after completing a strict course of somewhat more than mere elementary education, therefore, that a student should be permitted to attend the superior schools of the Academy, and not without

his being first subjected to a strict and intelligent public entrance examination. In the Academy he should find himself provided with models for study of every kind, of the highest excellence which the best casts can supply,* and the schools should be carefully divided, so that each class (as of figure drawing and figure painting from the antique, drawing and painting from the life, modelling from the antique and from the life, landscape, etching, and engraving, &c.) should be separate, and each class conducted by the ablest masters in that particular department, who might also with great advantage introduce the custom of themselves painting and modelling in the presence of the students of the Academy. During the hours of drawing or modelling from the life, the Master should be invariably present, not only to preserve order and proper attention, but to direct the proper use of such models, and to guide to its highest results this the most important as well as the most difficult branch of the student's labours. In all these classes the powers of the student would be guarded not only by the experience of the Professor, but by the gradations prescribed in a proper system of teaching, from attempts beyond their strength; and he who had entered the Institution with only a true eye and steady hand, an elementary knowledge of Anatomy, and some practice in drawing and painting the more simple forms presented by the human figure, would be advanced by little and little to a practical familiarity with the best and most difficult designs of past genius, and with the highest manifestations of the power and beauty of the living works of creation. Lastly, each branch of practical study in Art, as well as those branches of science allied to it, (as Anatomy, Comparative Anatomy, Botany, Geology applied to Landscape Art, and the Chemistry of Colours, as well as Perspective, Drawing, Colouring, and Composition,) and in addition to these the History of Art in general, and the practical applications of Art in Decoration and Ornament—all these topics should be made the subjects of annual courses of lectures, the chairs of which should be filled by the ablest scientific men in the metropolis. The public, too, should be brought directly under the influence of such an Academy, by being admitted to some or all of these courses of Lectures. The Art of Architecture would of course form a separate department, to be taught theoretically and practically in a similar manner.

Such an Academy would be, as it appears to us, efficient and complete, so far at least as forms and system could make it so: the rest must depend upon the spirit and ability of its members, the Professors and managers of its various schools. And to provide for its including always the best proficients in Art existing in the country, as well as to draw close and perpetuate the connection of the Academy with, and its recognition by, the profession outside its walls, the corporation should be so framed as to represent the profession generally as freely and fairly as possible. Such an Academy never yet lived save by help of national support, and Ireland cannot be expected to supply the first exception to a rule which neither

* And its schools should be in the neighbourhood of the NATIONAL GALLERY, when founded, so as to have the benefit of the practical use of the works which it will contain.

France nor Italy has been able to ignore or disprove; such an Academy (for its Professors must be properly remunerated) must be much more largely supported than by the paltry grant of £300 a year doled out to the shadow of it at present in existence in Abbey-street, which is barely adequate to remunerate *one* competent officer. It would be, on the other hand, a fitting return to demand of the profession a payment to the public in kind, and that which we should suggest would be, that each year the Academy—and its members all in turn—should contribute to a department of the National Gallery some one worthy Work of Art, commemorating or illustrating the history or life of this our Nation of Ireland. It is thus that the genius of the artist might best become known, and being known, live for ever; while at the same time his influence, that of the Academy, that of Art itself, would be most favourably and most powerfully exercised upon the mass of the people, for whom all highest Art really is.

We have now pointed out those portions of a comprehensive system of Education in Art which may be realized by some expansion of existing Institutions. The elementary or primary part can be at once introduced into the ordinary primary schools all over the country. The final College of pure Art may take the form of a reconstituted Hibernian Academy, provided the various departments above sketched out be adequately filled, and pecuniary support be secured by the state to an extent sufficient to command, by adequate remuneration, the services of the best men among us in so many different chairs and masterships. An intermediate space remains in the system to be provided for, and here we should require a class of schools which, in their relation to the Academy itself, indeed, would be elementary in character, but in which Art alone, in its various departments, would be taught, unmixed with and quite apart from any other branch of education. In the primary schools but the merest rudiments of drawing could be introduced as a very subordinate part of a substantial general education. In the separate Schools of mere Art this subject alone should be attended to, although the quantity of time required from each student in the course of the week may be small enough to leave time undisturbed in the pursuit of other studies where the profession of Art should not be his destination. Of this class of school we shall not need to draw any description in detail. The plan, principle, and practice, upon which such schools ought to be conducted form the subject of one of the ablest Reports upon any subject we are acquainted with, that drawn up by M. RAVASSON, (the Inspector General of Superior Instruction in France,) of which a translation in full was printed in a former number of this *Journal*.* In that report (which the reader should carefully study if he wishes really to understand this subject) every detail will be found, and if we had space now to go over the same ground, we should, in fact, but make extracts from that admirable document. Intermediate schools should, of course, be estab-

* *Journal of Social Progress*, No. VI., June, 1854, page 81—102. It is the report of a Government Commission on the subject of Education in Art, especially in Ornamental Art, in France; a commission including some of the most distinguished Artists and Professors in that country.

lished in the chief provincial towns, wherever the extent of population made it likely they would be adequately attended, and these schools also would manifestly require substantial support from the state, in addition to the sums which might be received by them as fees for instruction. They should be directed by well-trained masters, and the course of education there should proceed as high as, at least, the correct drawing, and simple painting, of the single human figure, and of the simpler forms of animals, vegetables, and rocks, made intelligible by a good elementary education in Anatomy, and some instruction in Botany and Geology. From such schools the academy would draw its pupils, and the ambition of the abler students might be encouraged by prizes and medals, and by Exhibitions of sufficient value to provide for their education for some time in the schools of the central Academy in Dublin. In these schools, also, should be provided a distinct system of Education in Ornamental and Decorative Art, which might be attended by mechanics and artisans of every kind, who should be encouraged to learn its principles by being admitted at the lowest rate of fees, by prizes, and, of course, by an arrangement of the hours of instruction, which should be made convenient for them, without interfering with their regular employments.

And here we had intended to offer some remarks upon the system (if indeed it can be called so) on which the English Government have, through their Board of *Trade*, attempted to direct some general education in art in England, and from which, we regret to say, Ireland has not had the good fortune to escape. But the limits of our space compel us to postpone this subject to another opportunity. The utter failure of the "Department of Art" set up by the Board of *Trade* above mentioned, begins to be pretty generally acknowledged, as the able and spirited resolutions of the local committee of the Manchester School, last summer, and a similar movement in Belfast a few months before, seem to indicate. In Dublin we have had one of the worst conducted establishments of any, and that of late, it is understood, in spite of the Committee of Management placed over it: but in Dublin the only school of Art has unfortunately been buried under the shadow of the Royal Dublin Society, whose incompetence for such a trust has long been rather the laughing stock than the subject of serious complaint among those who look into such matters in Dublin. Upon the system developed in blue books, and the practice of it in Ireland,—especially in the case of the Dublin Society's school,—we shall take another occasion to make a separate exposition of, what we believe to be the truth, to our readers, and if it may be, to all such of the public as have at heart the interests of Education in Art in Ireland or any where else; and we believe they will find in the subject a lesson and a warning of no light import. For the present, however, we must rest content with the hasty sketch we have made (by way of suggestion) of a possible system of national Education in Art, and of its complete development in a true national Academy worthy of a metropolis.

The entire system here suggested would consist then of a National Academy, a series of secondary Schools of Art, (of which there should be at least eight: as in Dublin, Cork, Belfast, Limerick, Waterford, Clonmel, Galway, and Derry,) and the addition of elementary instruction in Art by the aid of proper books, to the course of education now practised in the primary schools throughout the country. The whole expense of such a

system, vast as it is, and great as must undoubtedly be the results of it, would be comparatively small, very little more indeed than that of the system of Musical Education proposed in a late number of this Journal; our calculation would lead to fixing £6000 a year as a sufficient sum to remunerate a proper staff of teachers and professors in the first instance, and we have little doubt that the impetus given to Art in the country by such an establishment would, after a very few years, produce an abundant additional income, by fees and subscriptions, so as to provide for a still better payment of that staff and for a further extension of the system. (That calculation is given below.)* If this be the case it is to be hoped there are sufficient of enlightened men still in Ireland to recognise the vast importance of completing such an undertaking, and of insisting on the appropriation to this purpose of the small sum necessary out of the general taxation of the country.

One word before we conclude. It is notorious that in England there are few if any students of Drawing, scarcely an Academician even who can *draw* correctly, though many artists that can colour well. It is equally notorious that there is very little cultivated taste for, or knowledge of the principles of, Art, even among the cultivated classes in England. It is likewise certain, on the other hand, that in France education in art has reached great perfection, and that in Drawing especially the system and the teachers of France are unrivalled. We would, therefore earnestly impress upon the friends of Art in Ireland the propriety of introducing the *French system* of instruction here, and introducing it by the aid of *French teachers*. If the measures here suggested be ever taken, we feel convinced that the noblest results will follow in every department of Irish life both spiritual and material. If they be taken *now*, we feel equally persuaded that this time will be found peculiarly favourable for their cordial general acceptance and immediate success.

* The expense of the Metropolitan Academy may be taken at about £2,000 a year. The Master of the Life Academy and Teacher of *Painting*, should receive, at least, £300, besides an additional £100 a year as Professor, for the necessary courses of Lectures on Drawing, Painting, and *Composition*. The Master of the Antique Academy and Teacher of *Drawing*, at least £300. The Master of *Modelling* (since pupils in this class would be fewer, and less time occupied) £200, besides £50 additional for a course of Lectures as Professor of *Sculpture*. The Master of Landscape £300. The Professor of *Architecture* £200, besides £50 additional for a course of Lectures on *Perspective*. The Master of *Etching* and *Engraving*, £150. An Academician should receive £50 for an annual course on the *History of Art*; and another should receive £100 for the necessarily longer course on the principles of the *Application of Art to Ornament and Decoration*. Lastly, there cannot be less than £50 each devoted to the four auxiliary courses of *Anatomy*, *Comparative Anatomy*, *Botany*, and *Geology*, (all as applied to Art,) and the *Chemistry of Colours*. Total, £2,000. In each of the eight Schools of Art of the second class, at least three teachers would be necessary, namely, a Master of Drawing and Painting at £200; a Master of Landscape and Ornament at £200; and a Master of Modelling at £100, or £500 each, that is in all £4,000. Total expense of the entire staff required in the whole system, £6,000. Some of these sums may be objected to as too large; in our opinion nearly all of them are too small. We have bad masters in every school, precisely because we do not offer salaries which well-educated men will accept, and thus education suffers on the one hand, while on the other the Artist almost becomes a mechanical tradesman, because he is treated as if he were one. Until this part of our false system is corrected, every other arrangement, how splendid soever it may appear on paper, must prove barren and idle as the wind—unless, indeed, to supply material for blue books, and such like valuable additions to literature.

ART. II.—*Proposal to establish an additional Bank in Dublin considered.*
Second Article. By "TURGOT."

TO THE EDITOR OF THE JOURNAL OF SOCIAL PROGRESS.

MY DEAR SIR,—The paper which appeared in your October number, on the "Establishment of an additional Bank in Dublin," has, as you are aware, excited considerable interest not only in our metropolis, but also in Belfast, Glasgow, and some other towns. So far as I have been able to ascertain it, the general conviction on the mind of the public seems to be that the views therein propounded are substantially correct. Some dissenting voices there undoubtedly have been, though certainly not more than I had been prepared to anticipate; but the objections raised are not of the most vital character, and all, without exception, refer to points that will admit of easy explanation. To that explanation, however, your readers are fully entitled, and I feel the more pleasure in rendering it, as I am conscious of not having been able to do justice to several branches of the argument within the limits which a short and rapid *resumé* imposed upon me.

For the sake of greater clearness it may be as well to premise that the paper referred to was devoted to the consideration of three distinct points: 1st, the enunciation of one or two of the essential principles of all correct banking; 2nd, a statement of the actual practice of our metropolitan banks in reference to those principles; and 3rd, the suggestion of what I considered the best remedy for the defects existing in that practice. It follows, therefore, that objections might be raised on independent grounds to each or all of these three sections.

With reference to the *theory* of the subject, I am happy to state, that up to the present time I have heard of but one objection being raised to any of the principles propounded in the paper. These consisted of three; two more important, and one less so. The first was to the effect that a sound system of banking must comprise not only the transactions arising from the discounts of its supporters, but also the granting of advances in the form of "cash credits" upon personal and other securities, to such as may find an accommodation of that description necessary. The second was intimately connected with the preceding, and required that each bank should transact all the business of its customers. And the third, as supplemental to the former two, insisted that no banking system can be complete which does not encourage the practice of economy amongst our retail dealers and minor capitalists, by allowing them interest on the daily balances of their operative deposit accounts. As neither of these three principles has been at all impugned, at least with a single exception, to which I shall refer hereafter, it will hardly be thought that they stand in need of any further confirmation.

With regard to the statements respecting the actual practice of our metropolitan establishments, I might almost express myself in terms no less emphatic than the preceding. The amount of objection that has been offered to this part of the paper has been extremely trifling. Indeed the facts of the case are too well understood to admit of doubt or contradic-

tion. Every one who keeps a banking account must be aware that our banks are not in the habit of granting the permission to overdraw, save in cases so exceptional, as to amount in the year to a very small per-centage upon the sums annually advanced in the form of discounts. Nor can it be less generally known that nearly all our extensive merchants are obliged to keep accounts open with two or more banks simultaneously, in consequence of their inability to have all their discounts transacted by any single bank. And as to the encouragement of small accounts, the very great proportion of our retail traders, whose names are not enrolled amongst the customers of any bank, is sufficient evidence of the inadequacy of our present arrangements, to provide for the existing wants of this large and very important class of our most industrious citizens.

It has indeed been said by a correspondent in a private letter, that one of our Dublin banks, at least, is in the practice of "giving cash credits to every one who asks for them, and is entitled to receive them." Now, I am not at all disposed to dispute the fact that the bank referred to may be in the practice of granting them in certain cases. But the question between us hinges entirely upon the *extent* to which they grant them, and the adequacy of the amount so granted to meet the requirements of our citizens. Another gentleman (a bank director) has hinted that I must be misinformed as to the extent to which they are granted in Scotland. To both of these objections it will probably be sufficient to reply, that we have no less an authority than a committee of the House of Lords, which was appointed in 1826, to report on the question of Scotch and Irish banking, for the fact, that in Scotland every one who can produce two or more competent sureties, and whose character, the nature of his business, and the sufficiency of his securities, will bear the test of full examination, "is allowed to open a credit, and either to draw upon the bank for the whole of its amount, or for such part as his daily transactions may require;" and that the total amount of credits so granted has been estimated at five millions, sterling, of which the probable average amount advanced at any given time might be one-third. And if this estimate be corrected up to the present date, so as to correspond with the rapid development of trade and manufactures throughout the intervening period, it is obvious that the five millions would be augmented to the extent of one or two millions more. Nor is the evidence less conclusive with regard to some of the principal towns in England. The following is taken from the third half-yearly report of the Royal British Bank, an establishment recently opened in London for the transaction of business on the Scotch system:—

"The whole payments made by the bank in cash credits have been, since the opening, 39,964, amounting to £1,142,838, averaging £28 10s. each; and the whole receipts 15,216, amounting to £1,009,694, averaging £66 6s. each. Had the above payments been made by the ordinary method of discounts, the stamp duty alone would have cost the parties £4,995 10s., besides a vast amount of trouble from which they are exempted by the method of cash credits."

In this sense, at least, it must be admitted that cash credits have never existed in Dublin, nor indeed in the central and southern districts of the island. And yet if a single bank in London, which is very far from being one of the most extensive in that city, could advance cash credits to the

amount of more than a million, sterling, in the first eighteen months of its existence, I think it would not be too much to expect that our Dublin banks, which possess an aggregate paid up capital of nearly five millions, and whose total available resources can hardly fall short of three times that amount, should devote some half million or so of those resources to a species of investment that, wherever it has been tested, has invariably been found as lucrative to the banks themselves, as it has been advantageous to the community at large.

I have also been informed by another gentleman, that the bank with which he is connected is accustomed to give cash credits in all its branches, "but that inasmuch as it never gives them without being fully secured in the amount, it is perfectly immaterial whether the recipient has a second account or not." As this is the instance to which I alluded before, and the only one of which I have yet heard in which either of the three principles has been called in question, it must not be passed over without some words of explanation. So far as the practice of the bank is concerned, the simplest and most forcible proof of the unsoundness of the principle by which it is guided in its cash advances, is to be found in the extremely limited extent to which its customers have ever been able to avail themselves of them. The advantages presented by a cash credit, as compared with a mere discount account, are so superior, that there are very few in the practice of keeping the latter, who would not at times avail themselves of the former, if the restrictions under which they are limited were not equivalent to a practical prohibition. But the incorrectness of the principle may be shown by a more direct process. For however stringent the bank may be in its requirements of ample securities to cover the amount of its cash advances, it is obvious that its inflexibility in this respect will not suffice to protect its interests, unless it applies an equally stringent rule to the transaction of its client's discounts, and this it cannot possibly do, so long as it possesses no clearer insight into the nature of his business and the solvency of his position, than that which it can derive from discounting a mere fraction of his indorsements. If, indeed, the majority of his own acceptances were made payable at the bank by which his discounts are transacted, the nature and extent of these would, no doubt, furnish the most accurate of all criteria by which to judge of his general solvency, but as this is seldom practically the case in Dublin, it is clear that the only adequate substitute is the nature and extent of his indorsements, and where the majority of these do not pass under the review of the bank, there is no remaining source from which it can obtain the requisite information. Nor is it less evident, that wherever this system prevails, it must operate as an effectual barrier to the existence of that mutual confidence and friendly feeling which ought to characterize the relations of a banker with his clients. And where these do not exist, we may always expect that the insolvent trader will protect his general creditor to the disadvantage of his banker, a result of which Dublin has presented some striking illustrations, within the recollection of every reader.

As the question under consideration in the former paper was that of our Dublin banks exclusively, it did not seem necessary to refer to the

nature of the accommodation provided in the provincial branches. But without entering into the general subject, it may not be amiss to observe, that in the rural districts the better classes of farmers occupy the same position relatively to the branches in their vicinity, that our retail traders hold in Dublin in relation to the central establishments. Like the latter, what they principally require is encouragement to place the proceeds of the sales of their produce in the hands of the banker, until such time as it may be requisite to draw upon them for their agricultural operations. At present, as they are not allowed interest upon the balances to credit of current account, and as they are not permitted to overdraw for the expenses of gathering and preparing the crops for the market, there is not sufficient motive to induce them to do this. As a necessary consequence, their general practice is, either to leave the money in the hands of the merchant with considerable risk, and often with loss to themselves, or else to retain it altogether inoperative in their own possession. Indeed, cases are not unfrequent in which they actually pay the March rents in advance to the landlord, in preference to the supposed risk of loss attendant upon either of these courses. And in this way the total sum that is practically lost to the farmer for several months annually, must amount to a considerable percentage of the reproductive capital of the country.

Before leaving this part of the subject it may be as well to add, that although it is not possible to prescribe any fixed rule as to the amount that may safely be advanced to any individual in the form of a cash credit, yet that both the theory of the subject, and the practice of those banks which follow the cash credit system, unite in proving that any person whose position is sufficiently solvent to entitle him to keep a discount account with any bank, might not unreasonably expect an occasional advance of this description, to the extent of one-tenth part of the amount operated upon in the course of the year. For example, if his discounts in the year amount to £10,000, any solvent trader might not unreasonably look to his banker for an occasional credit to the extent of £1,000. In many cases, indeed, he might not find it necessary to avail himself of the privilege to so great an extent as this; but if his general solvency is indisputable, and if by keeping a discount account open with only one bank, he enables that bank to understand the nature of his position with his creditors, I believe I am confining myself within very moderate limits when I say that he ought to be able to rely upon an advance to that extent, whenever the requirements of his business may render such an advance desirable.

So far as to the correct principles of banking, and the practice of our Dublin establishments. I shall now proceed to the practical suggestions; and with respect to these I must admit that they have met with a greater amount of dissent than either of the other two. My principal critic, however, though a very friendly one, has been your respectable cotemporary, the *Belfast Mercantile Journal*. In a long article in the number of October 24th, the editor of that eminent commercial authority has controverted some of the views propounded in the paper. With all the principles therein laid down, he appears, as far as I can judge, cordially to unite. On the practice of our Dublin banks, too, he offers no opinion essentially

different from mine. But with regard to the practical suggestions, the conclusion which he enforces is, that the best mode of removing the evil, the existence of which we both agree in deploring, is, not the adoption of an improved system by our present banks, but the establishment of a Belfast branch amongst us. I must acknowledge, however, that with every desire to give my critic's arguments their full weight, I have not found them sufficiently strong to induce me to alter my views; and as my limits were too restricted in the former paper to allow me fully to state the reasons that determine my conclusion, I shall embrace the present occasion of unfolding them at greater length, not only for the sake of my friendly critic himself, but also for the better enlightenment of the public generally, on this important subject.

As I have already stated, the amount of paid up capital possessed by our five larger Dublin banks is nearly five millions, sterling, while their available resources of every description cannot fall far short of fifteen millions.* I have no precise data from which to estimate the exact proportion of these fifteen millions that is employed in the operations of the metropolitan branches, but there can be no doubt that it must be very considerable. Now a reference to the last month's banking returns will show that of these five banks, the three banks of issue are in possession of an aggregate unemployed reserve fund of not much less than two millions. Of these two millions it will hardly be considered an over-estimate, if I assume that one million would suffice for all the ordinary purposes of reserve, and that the remaining million might safely be employed in the transaction of any legitimate business that might arise to require it. In like manner, if that million were divided into two equal portions, one half might be employed in the metropolis, and still leave another half for distribution amongst the various provincial branches. It seems to me therefore very evident, that the five banks have it in their power, if they should desire it, to employ, at least, half a million of their present available resources, in the advancement of cash credits in the metropolis alone, without, in the slightest degree, interfering with their existing arrangements in other respects, and without requiring the contraction of their discounts to the extent of a single note.

But if this estimate should appear too large, I am willing to reduce it by another half, and to assume that the total unemployed resources of our Dublin banks available for advances of this description, amount to only one

* In order to prove that this is not an over estimate, I append a statement of the Bank of Ireland's available resources on 12th February, 1848, the last date given in their general statement of liabilities and assets from February, 1841, to 1848, furnished to Committee on Commercial Distress.

Authorized circulation	...	...	...	£3,738,428
Specie against which notes might be issued	...	...	...	808,500
Deposits, Public	...	...	£1,336,600	
" Private, and Sundry Balances	...	...	2,160,500	
				3,497,100
Securities, Public	...	...	3,735,800	
Deduct lent to Government, unsaleable	...	...	2,630,770	
Marketable Securities	...	...	...	1,105,030
Available banking resources	...	..	...	£9,149,058

quarter of a million, that is, to about one-eighth part of their reserve fund. There can be no doubt, I think, that if the judicious employment of this quarter of a million were combined with the encouragement of small deposit accounts with that large proportion of our traders who do not at present keep an account with any bank, the effect would probably be to increase the available resources of the five banks by another quarter of a million of deposits; so that the actual result upon the metropolitan operations can hardly be estimated at less than an addition of half a million altogether. And if even one-half of this, viz., £250,000, were expended in advances to our manufacturers, and operated on twice in the year, it would enable them to provide employment for at least 10,000 additional hands, and thereby contribute to the support of perhaps some 50,000 of our population. And this without interfering with the present disposal of their actively employed resources, without diminishing the advances to any of their customers in the form of discounts, or in any other way producing any countervailing injury.

I think it must be evident at a glance, that the establishment of a Belfast branch here could not, even in the most favourable circumstances, produce results that would bear any comparison to those which I have just mentioned. The total amount of the reserve fund at the disposal of the three Belfast banks is, at the present time, about £150,000, and of this sum the Northern Banking Company alone are in possession of more than £50,000. The average reserve in the coffers of the latter during the month of October was £75,000, say £80,000, for the sake of greater simplicity in our calculations. Now supposing that one-half of this reserve, viz., £40,000, were to be employed in the establishment of a branch in Dublin, and that is, undoubtedly, as much as could with prudence be abstracted from the other branches, the operations of such an establishment would probably assume a character somewhat of this description. The capital would amount to £40,000, and the deposits, including some transfers from the other banks, would, in all probability, be under £80,000; so that the whole available resources of the branch may be computed at about £120,000. Of this, at least £20,000 would be retained inoperative by the branch as a reserve, and three-fourths of the remaining £100,000 would be expended in discounting the bills of its customers, which would leave not more than £25,000 to be employed in cash credits. According to the preceding computations, therefore—and I am not aware of their being at all exaggerated—the Belfast branch could not employ, in cash credits, much more than one-tenth part of the funds that are indisputably at the disposal of our present banks, and available for that purpose.

There are, indeed, three conceivable courses by which the funds of such a branch might be increased to an extent considerably greater than that which I have just supposed; but the policy of adopting either of them would be so injurious to the interests of the shareholders, that I should not mention them at all if I did not deem it necessary to show that I have not overlooked their abstract possibility. The first of these would be by means of a further call upon the unpaid capital. But inasmuch as many of the shareholders would be unprepared and unwilling to meet this call,

and as the result might be to diminish the rate of dividends, the shares would be thrown upon the market, and probably depreciated in value to an extent commensurate with that of the call; there is, therefore, no likelihood that such an expedient would ever be resorted to, except in a case of the most vital urgency. The second course would be scarcely less suicidal. A certain portion of the deposits might be withdrawn from the provincial branches, and transferred as a working capital to the metropolis. In this case, however, the transfer of such a sum as would give the branch a respectable standing in Dublin, would cripple the resources of the former to as great an extent as the latter would be increased, so that at best a certain advantage would be sacrificed for the sake of a very uncertain contingency. And if any circumstances should arise to induce a run upon the deposits in any one or two of the provincial branches, they might not find it possible to meet it with sufficient promptitude.

The remaining course will require a somewhat fuller examination. It would be quite feasible for such a branch to increase its operations indefinitely, by entering into a reckless competition for the metropolitan deposits. Upon a *bonâ fide* basis of £40,000 in gold and notes, for instance, there is nothing to prevent it from obtaining deposits to six or even eight times that amount. But a little consideration will show that the consequences of the adoption of this course, and of employing so disproportionate an amount of deposits in discounts and loans to its customers, would be no less fatal than those of the preceding. As a general rule it may be observed, that banks of issue do not find it prudent to operate upon their deposits to an extent much greater than the amount of the gold and notes at their disposal. And whenever this proportion is exceeded, it can only be at the expense of incurring a corresponding risk of inability to meet their engagements. In the case supposed, therefore, this risk would be very seriously aggravated. So long as the general trade of the city continued flourishing and credit abundant, the effect might not be very sensible, but every fluctuation in the money-market would be severely felt, and the first considerable prostration of public credit would be likely to produce so great a run upon the deposits, these being virtually the whole resources of the branch, as would compel the bank, in self-defence, to contract the larger proportion of its discounts. It is obvious that a measure such as this would be fatal to the interests of many of its customers, but it is far from certain that it would suffice to secure the bank itself. For if the general contraction of credit were so rapid that the demands upon the deposits exceeded the rate at which the bills under discount became due and were paid, and if the difficulty of having those bills rediscounted were anything like so great as during the pressure of 1847, there is hardly any measure which could prevent temporary suspension, except either a very heavy draught upon the resources of the other branches, or else a call upon the unpaid capital of the shareholders themselves. And as I have already shown, the adoption of either of these measures would be fraught with so much peril to the interests of the shareholders, that no prudent banker would be willing to incur the risk, except in a case of the most urgent necessity.

It seems to me indisputable, therefore, that if a branch of one of the

Northern banks were established here, it would unavoidably be compelled to adopt one or other of these alternatives. Either it must confine its operations somewhat nearly within the limits above explained, or else it must incur the perils attendant upon some one of the courses that I have just described. In the one case, the extent of its business would be too contracted to exert any sensible influence upon the interests of our citizens generally; in the other, whatever additional business might be transacted, would be obtained by increasing the deposits to an extent totally disproportionate to the paid-up capital of the bank.

In these circumstances I do not see how it can be reasonably doubted, that the more rational course for our merchants to pursue is that which I recommended in the former paper. I have shown that an alteration in our present system of management would produce all the results that we desire; I have also shown that our present banks have sufficient surplus funds at their disposal to supply all the additional accommodation, without in any way disorganising the present course of trade; and that being the case, it seems to me far more reasonable that we should struggle for reform within ourselves than that we should seek for assistance from any extraneous source, no matter how competent that source may be to provide for our requirements. And if this be true as a general rule, even in the most favourable case, it appears much more undeniable when that assistance, so far from being sufficient, bears no adequate proportion to the extent of our wants, and when, even if we had actually obtained it, we should still have to look to our present establishments for any measure that would impart a new and vigorous impulse to our manufacturing industry.

I do not wish it to be supposed, however, that in advocating this course I have been actuated either by any desire to shelter our Dublin banks from a legitimate competition, or by a feeling of hostility to those of the Northern province. The Editor of the *Mercantile Journal* appears to regard me as somewhat of a panegyrist of the Bank of Ireland. But the freedom with which I have criticised our present system ought to have shown him that I write in the interest of the public generally, and not in that of the proprietary of any bank; and as far as the Belfast banks are concerned, there is none of them towards which I entertain other than the most friendly feelings. I am not perfectly informed as to how far they carry out the second and third of the principles laid down above; but I am fully aware that their system is very much in advance of ours, and I should wish to give them every credit to which they are entitled. Still, I consider that on a question so vitally affecting the interests of Dublin, and indeed the whole southern portion of our island, as the present, what we should especially hold in view is, the interest of our population generally; and that we should not allow our judgment to be warped by any personal bias or private partialities. That is, accordingly, what I have endeavoured to do in the discussion of this question; while I am pleased to acknowledge the advanced position of Belfast in banking as in several other respects of the highest importance, I am still of opinion that any adequate reform in our own banking system must be looked for through our present establishments, and not through the opening of any new bank here, however sound may be its principles, or however extensive its resources.

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